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## Transactions of the Australasian Medical Congress (British Medical Association)

Second Session: Dunedin, February 3 to 10, 1927



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## SECTION XII.—RADIOLOGY—(Continued).

### X RAY DIAGNOSIS OF DUODENAL LESION.

By H. R. SEAR, M.B. (Sydney),  
Honorary Radiographer, Royal Prince Alfred  
Hospital, Sydney.

(Continued from page 224.)

This seems to be quite contrary to the teachings of Moynihan who states that he is amazed if he diagnoses a case clinically as one of duodenal ulcer and operation proves his diagnosis erroneous.

Table II reveals how inadequate and misleading symptoms may be. I understand that this is the opinion also of some of the leading abdominal surgeons elsewhere.

The dissection of the symptoms of the patients in whom duodenal ulcer was found, is given in Tables III and IV according to whether the ulcer caused obstruction or not.

TABLE III.—SYMPTOMS PRESENTED IN DUODENAL ULCER WITHOUT OBSTRUCTION.

Symptom.	Number of Patients.
Hunger-pain .. .. .	193
Hunger-pain and vomiting .. .. .	46
Hunger-pain and hæmorrhage (with either .. .. .)	88
melæna or hæmatemesis)	24
Pain only (not hunger-pain) .. .. .	19
Pain and vomiting .. .. .	4
Pain and hæmorrhage .. .. .	1
Hæmorrhage only .. .. .	
Total .. .. .	375

TABLE IV.—SYMPTOMS PRESENTED IN DUODENAL ULCER WITH OBSTRUCTION.

Symptom.	Number of Patients.
Hunger-pain .. .. .	61
Hunger-pain and vomiting .. .. .	39
Hunger-pain and hæmorrhage (with either .. .. .)	37
melæna or hæmatemesis)	21
Pain only (not hunger-pain) .. .. .	14
Pain and vomiting .. .. .	4
Pain and hæmorrhage .. .. .	1
Hæmorrhage only .. .. .	
Total .. .. .	177

These two tables may not include all the cases of duodenal ulcer occurring in this series, for probably

some of the cases classified in Table I as juxta-pyloric ulcer were duodenal.

Moynihan condemns this term "juxta-pyloric." He holds that the pyloric veins as described by Mayo should settle at once whether the ulcer is gastric or duodenal and that actual pyloric ulcer is extremely rare.

Unfortunately the pyloric veins cannot be detected radiographically. In many cases, however, the surgeon has notified me that at operation an ulcer was found so close to the sphincter as to render it impossible to classify it positively as either gastric or duodenal in origin (see Figure I).

I should like to point out that the incidence in male and female of gastric ulcer is 1:1, of duodenal ulcer is 4:1, of juxta-pyloric ulcers about 2:1, which does not suggest that these are all duodenal ulcers for the ratio is different to that of duodenal ulcer.

Moynihan further states that a gastric ulcer is very rarely within an inch and a half from the pylorus. I cannot agree with this statement, as I have seen many gastric ulcers in which the crater is in the immediate sphincteric region, so that I shall adhere to this term juxta-pyloric and show slides to demonstrate this condition.

It has been said that the history of duodenal ulcer shows the cycle—food, comfort, pain; whereas the cycle of symptoms of gastric ulcer is food, comfort, pain, comfort.

But in many cases of gastric ulcer fairly high up on the lesser curvature I have found exactly the rhythm of duodenal ulcer, namely food, comfort, pain, that is, there may be definite hunger pain in gastric ulcers occurring fairly high up on the lesser curvature.

The diagnosis of duodenal ulcer can be made with any degree of certainty only by radiographic means. I do not hold that the X ray examination is infallible; only too well do I know of errors I have made, but I hold that without X ray examination the diagnosis must remain open to doubt.

The Röntgen signs of duodenal ulcer are usually classified as follows: (1) Direct: deformity of duodenal contour, (2) indirect: (i) alterations of gastric tone, (ii) alterations of gastric peristalsis, (iii) alterations of motility, (iv) six hour residue, (v) tenderness localized to the duodenum.

I shall deal with the indirect first. Indirect signs may suggest duodenal irritation, but experience has

proved that they are quite unreliable as a basis for the diagnosis of duodenal ulcer.

Prior to 1914 when Cole first and then George published their papers and methods of the positive diagnosis of duodenal ulcer by the direct method, we (the late Dr. Herschel Harris and I) followed the teachings of the continental radiologists and worked to certain symptom complexes. We may have been right in some of our diagnoses, but we were certainly wrong in many.

For example I well remember examining a friend of the late Sir Herbert Maitland for duodenal ulcer; his stomach emptied in normal time; there was no hyperperistalsis and no hypertonicity and I reported no duodenal ulcer; this man's duodenal ulcer perforated that night.

This mistake would probably not have occurred had we examined the duodenal bulb as is now invariably done.

It was, as I have said, in 1914 that Cole published this method and later in that year George propounded his seven propositions which with slight modifications have stood the test of time. It was with relief that we turned to this direct method of diagnosis, namely the demonstration of a duodenal deformity.

I shall give these seven propositions of George briefly.

1. The positive method consists in demonstrating adequately the anatomical condition of the first portion of the duodenum.
2. Ninety-five per cent of duodenal ulcers occur in the first portion of the duodenum.
3. Anatomically the first portion of the duodenum is a constant entity.
4. If normal, the first portion of the duodenum can always be demonstrated on a plate with characteristic shape.
5. A constant defect in this duodenal cap means a pathological condition. This may be ulcer, adhesions, cholecystitis or anatomical or accidental variations, such as pressure of adjacent organs *et cetera*.
6. Any duodenal ulcer which is more than a simple mucous membrane erosion, will deform the outline of the opaque mass.
7. A normal *bulbus duodeni* or duodenal cap on the plate rules out indurated or surgical duodenal ulcer.

I do not hold the view that no duodenal ulcer escapes the röntgenologist. In some cases we hear that we may have missed an ulcer and again many patients may be referred to us in whom there has been only a short history with possibly one attack of hæmorrhage, say four weeks before coming for the opaque meal and in the interval they have been under strict treatment.

Such an ulcer may possibly have healed or at any rate the spasm accompanying the ulceration and causing most of the deformity may have yielded to treatment and the mucosal defect is so slight that we may not be able to detect it.

As regards technique though many so-called new methods are propounded, they usually do not have any newness to a man constantly at this type of work.

Screen examination is essential with manipulation, often bimanual and, of course, screen examination permits of examination in various planes, a most essential part of the process.

Radiograms are of more value as records or demonstrations to the surgeon; these should be taken in various positions, especially the right anterior oblique position. Sometimes the crater can best be demonstrated with the cap partially or almost empty, a modification of Gilbert Scott's method for detection of a gastric ulcer (Figure III).

Though the first essential in the X ray diagnosis of a duodenal ulcer is deformity of the duodenal cap, our aim should be to demonstrate the crater if possible.

The administration of belladonna has been advocated by Diamond and others in the diagnosis of duodenal ulcer; it relieves spasm and allows the crater to be visualized in a greater percentage of cases. It previously had its use in gastric cases to relieve spasm, but unfortunately it means a second examination of the patient who may not be able to afford this. On the other hand it would be unwise to administer belladonna before the first examination, as it would probably remove some of the deformity in relieving the spasm.

After Cole and George's papers numerous workers made attempts to classify deformities—the pine tree, the clover leaf and so forth and to correlate deformity with pathological conditions. This seems in many ways unnecessary; the main thing is the demonstration of the actual ulcer and secondly its effect on the motility or rate of evacuation of the stomach, for on this depends in many cases the subsequent treatment.

The constant clash of the physician and surgeon on the treatment of duodenal ulcer is of the greatest interest after the study of a long series of these cases; should or should not an operation be undertaken and when should it be done? It is a most significant fact that during the time in which I saw 549 patients with duodenal ulcer, 114 patients who had had gastro-enterostomy performed, came for examination on account of the unsatisfactory condition of their insides.

Duodenal deformity is usually divided into (i) the niche (the crater filled with barium), (ii) the defect, usually on the greater curvature border, due partly to spasm and partly to induration and cicatrization, (iii) retraction of the lesser curvature border, (iv) diverticular formations. I think that the induration and cicatrization are the main factors in the majority of these deformities.

Often radiographically the crater appears on the lesser curvature border (like gastric ulcer) and the *incisura* of the gastric ulcer is represented by spasm that causes part of the defect (see Figure IV). But with more experience more and more duodenal ulcers are seen to lie on the posterior aspect (see Figures V and VI); these are cases that in years past would possibly have escaped detection. It may be still harder to demonstrate in some cases the ulcer when it lies on the anterior surface. Such a case may show best when the duodenal cap is



almost empty, the crater containing its blob of opaque medium.

Diverticular formations (see Figure VII) seem to be a later manifestation and may go on to considerable dimensions; they are usually on the proximal side of the defect.

Occasionally the crater or niche is towards the greater curvature border (see Figures VIII and IX) and then the defect due to spasm is not so evident or may be absent; so also if the ulcer is on the base of the duodenal cap.

In the examination of the cases the first essential is to fill the cap fully and well, usually a fairly easy task, but occasionally especially in thick, well muscled men very difficult. Various positions of examination, various meals and examinations at various times after the opaque meal may be necessary.

In these cases the cap may be best seen one to two hours after the meal when the stomach has evacuated a large part of the opaque substance. I still adhere to the two meal method of examination using a moderately thick motor meal followed some six hours later by a fluid meal. The fluid meal is undoubtedly preferable to the motor meal for demonstrating filling defects; the motor meal, however, I hold is not to be discarded as it may yield information of great value to the physician in the treatment of these lesions.

Mechanical devices for blocking the duodenum below so as to fill the cap and loop above have been devised and their virtues extolled, but none yet have come into general use. I hope none will for the patient's sake.

As regards the differential diagnosis of duodenal lesions, Moynihan states that deformities of the duodenal bulb are as certain evidence of ulcer as the niche and notch in gastric ulcer. One might imagine from this that all duodenal deformities mean duodenal ulcer; this is far from being the case.

We may have the duodenal cap deformed, (i) by adhesions, either inflammatory or after operation. In this country one must always think of hydatids. (ii) It may be deformed by congenital veils, the web of Morris or the membrane of Harris, (iii) by pressure of other organs, such as the gall bladder, Riedel's lobe or other abnormalities of the liver or by disease of the pancreas, (iv) by growth in the duodenum, such as polypus or hæmangioma, (v) by diverticula, congenital in type. These are usually from the second, third and fourth portions of the duodenum, but may arise in extremely rare cases from the first part.

The diagnosis of the duodenal ulcer has been shown to depend on the filling and visualization of the duodenal cap, but where we have obstructions near the pyloric sphincter it may be a matter of extreme difficulty to determine whether this obstruction is due to a pyloric ulcer, which just lets an occasional fleck of barium pass through, or whether this fleck represents a greatly contracted duodenal cap, the actual cause of the obstruction.

In my experience 95% of duodenal ulcers are in the first part of the duodenum; the remaining 5%

occur below the cap and are as a rule found only if they cause obstruction and then it is the obstruction and dilatation of the duodenum above that is found. The actual cause cannot be determined radiographically; all we can say is that it may be due to ulcer, adhesions or possibly new growth. It is the obstruction and not the ulcer that we diagnose.

Both stomach and duodenum must be carefully investigated, even after one ulcer has been found, as frequently both a gastric and duodenal ulcer may be present. Carman says in 15%. In my series it occurred considerably less frequently, though it is not rare to have both lesions (see Figure XII).

In regard to adhesions the appearances vary greatly according to the site of the same. If they affect the first part, we may have a somewhat typical drawn-out cap, usually adherent or with impaired mobility. This cap is often characteristic even without palpation (see Figure XIII).

It differs altogether in appearance from the congenital veil type which usually maintains the typical bishop's mitre shape of the normal duodenal cap, but has an ill-defined, somewhat wavy, upper border (see Figure XIV).

The drawn-out type referred to above is the type most commonly seen after operation on the gall bladder and I have often seen it in patients with hydatid disease in this region. Adhesions below the first part usually give rise to a hitching up of the duodenal loop; this is often best seen in a semi-oblique position; sometimes if dense and contracted we may have obstruction at the site of the adhesions.

The hitching up of the duodenal loop is seen very typically in adhesions in unoperated gall bladder lesions and also possibly in hydatids on the under surface of the liver (see Figures XV and XVI).

Again the adhesions may be responsible for intermittent duodenal ileus occasionally met. This to my mind is a fairly rare lesion; a typical case is very characteristic (see Figure XVII).

At times it may possibly be difficult to display the condition well in radiograms, which may account for the apparently insufficient evidence on which sometimes such cases are diagnosed. Probably they have been seen quite well by screen examination, but the skiagrams do not demonstrate it well.

To my mind unless the delay is sufficiently definite to enable the radiographer to obtain good skiagrams, he should hesitate to classify it as such a lesion.

Actual obstruction in the duodenal loop is rare. I have seen it in mesenteric neoplasms; even in carcinoma of the duodenum (a very rare lesion) some blocking may be seen (Figure XVIII), but I have never seen in carcinoma of the duodenum an undoubted obstruction leading to the dilatation that may obtain in cases of mesenteric new growths where the duodenum may almost simulate large bowel.

Pancreatic lesions are also the cause of deformity in this region. Sometimes the enlargement of the pancreas may affect the head uniformly and lead to an exaggeration or widening of the duodenal loop (see Figure XIX); sometimes the pancreatic neoplasm is more localized and leads to a pressure defect on the duodenum or on the stomach. It may

possibly press on the stomach some distance from the pyloric sphincter and is then more frequently than not mistaken for a carcinoma of the stomach, being one of the fallacies in the so-called positive diagnosis of gastric carcinoma (see Figure XX).

The so-called concave pressure defect on the duodenal cap or stomach which is supposed to be due to the gall-bladder, is a most unsatisfactory sign. In some cases where this concave pressure defect has been well shown, tetraiodophenolphthalein proved that this defect is certainly not due to the gall bladder. I think it is quite as likely to be due to an abnormal liver as to the gall bladder. Again a hydatid or other mass in this region might cause it. I shall not enlarge on this, but I want to stress the risk we run of making an erroneous diagnosis, if we adhere to this sign without further investigation of the gall bladder.

Irregularities of the duodenum may be caused by growths such as hæmangiomata or polypi (Figure XXI), but here the lesion usually appears as a trans-radiant mass inside the encircling opaque media and it is not likely to be mistaken for ulceration.

Turning now to the much commoner condition of duodenal diverticulum (see Figures XXII, XXIII, XXIV, XXV and XXVI), it has been my good fortune to have seen quite a number of these cases, about twenty in this series of cases. If we are on the look out for them, they are not likely to escape detection. They usually occur in the second, third and fourth parts of the duodenum. I have only seen one in the first part. In many cases they have a definite connecting channel which may be difficult to demonstrate in the skiagrams, though it may be quite definite on screen examination. As I say they are not likely to escape detection; but there is a condition of irregular peristalsis of the duodenum which may give rise to the appearance of a pseudo-diverticulum, which may be mistaken for a true congenital diverticulum, and which may possibly explain some of the cases where a diverticulum of the duodenum is diagnosed radiographically, but is not found at operation. Figures XXVII, XXVIII and XXIX demonstrate this condition.

In my experience a diverticulum of the duodenum, if well filled, may remain filled long after the stomach and duodenal loop have emptied themselves. I have seen them filled twenty-four hours after the opaque meal has left the stomach. Again I should like to emphasize the fact that in addition to the true congenital diverticulum we may have a false diverticulum-like appearance which may be very deceptive, and in addition to these we have the diverticulum-like formations due to actual duodenal ulceration.

A condition, somewhat rare, that may be mistaken radiographically for a congenital duodenal diverticulum is barium in the gall bladder, due to the passage of a large gall stone leaving a fistula between the gall bladder and duodenum (see Figure XXX). This is a condition that I have seen only once; it could be differentiated positively only by a demonstration of a normal gall bladder by tetraiodophenolphthalein in the case of the congenital diverticulum.

Dilatation of the papilla of Vater, such as is not uncommonly seen in gall bladder lesions, must not be mistaken for congenital duodenal diverticula.

In terminating I should like again to emphasize the importance of careful screening in the diagnosis of duodenal lesions. Do not trust too much to the skiagrams which may show an irregularity due to a passing phase only and not a permanent defect.

#### RADIOLOGICAL APPEARANCES IN GASTRIC AND DUODENAL ULCERS

H. A. McCox, M.B., Ch.M. (Sydney),  
D.M.R.E. (Cantab.),  
Adelaide.

WITH the general advance in knowledge of all medical sciences within recent years it is not surprising to find that very rapid strides have been made in the field of radiology especially in regard to the examination of the gastro-intestinal tract.

In 1909 Reiche gave the first description of the finding of a gastric ulcer by radiography and in 1911 Haudek published an account of the duodenal niche due to duodenal ulcer. The claims of the latter were disregarded to a great extent and it was not till 1914 that recognition of duodenal ulcer by the direct method was established by Gregory Cole.<sup>(1)</sup>

Since that time knowledge of the radiological appearances of gastric and duodenal lesions has grown considerably. Through research and experience techniques which afford the maximum assistance in diagnosis, have been evolved and elaborated. These techniques have supplanted the less satisfactory methods formerly used.

The purpose of this paper is to describe a technique which is believed to be founded on sound principles, and which has proved itself to be satisfactory in institutions in which it has been used. The late Russell Carman and his colleagues, at the Mayo clinic, Scott and Vilvandr , at the London Hospital, and Barclay, at the Manchester Royal Infirmary, each use this technique with slight modifications to suit personal requirements. The views expressed herein are based on experience gained with these men and with the other members of the staff of the Radiological Department of the London Hospital with whom I had the privilege of working for two years, and to all of whom I wish to acknowledge my indebtedness.

#### TECHNIQUE.

##### Preparation of the Patient.

The stomach should be empty at the time of the examination. An aperient should be given thirty-six hours previous to the examination to eliminate the intestinal content and to allow time for the return to normal motility of the viscera before the examination commences. Castor oil is selected as the most suitable aperient. The patient must not take food for at least six hours preceding the examination.

### The Opaque Medium.

A fluid mixture of barium sulphate mixed with tragacanth in water and suitably flavoured forms a palatable and satisfactory emulsion. It has been contended that with such a mixture true knowledge of the motility of the viscera cannot be gained and the inclusion of various food materials has been advocated as necessary. Columbier,<sup>(2)</sup> of Paris, recommends an opaque food containing carbohydrates, fats and nitrogenous substances equivalent to 750 calories for each three hundred and fifty cubic centimetres of the meal.

Such additions necessarily reproduce more exactly the normal motility of the stomach and duodenum, but it is doubtful whether their use is essential when a satisfactory comparative knowledge of these movements may be gained by employing a simpler, a more easily prepared and a less expensive meal.

The meal should be sufficient in quantity to distend the stomach to its normal capacity and for this purpose about 0.57 litre (twenty ounces) suffices for an orthotonic stomach of average size. In a dilated and atonic stomach 0.57 litre merely forms a meniscus in the most dependent part of the body of the stomach when the patient is standing and hence only a small portion of the outline of the stomach is visualized. Provision is made in the technique to overcome this difficulty.

### Routine Examination.

Two meals are taken by the patient with an interval of six hours. A thorough examination of the stomach and duodenum is made immediately after the first meal is taken and six hours afterwards a further examination reveals information regarding the motility of the stomach, small and large intestine. The second meal is then given and the stomach and duodenum are reexamined to confirm the finding at the initial view. It is a common experience that the patient is less apprehensive when he submits himself for the second examination and consequently he is likely to relax his abdominal muscles more completely and thus allow of more efficient palpation. In these circumstances a niche due to duodenal ulcer may be revealed which was invisible at the first examination.

### Fluoroscopy.

"I believe that the advantage of the screen in the examination of the digestive tract can hardly be too strongly emphasized," (Carman).<sup>(3)</sup> It is by this means only that it is possible to make accurate observations of the peristaltic movement of the hollow viscera, their mobility and permanence of irregularity in contour. The examination is made with the patient in the erect posture behind the fluorescent screen. A rapid survey of the chest is made and any abnormality is noted. The oesophagus is well outlined during ingestion of the meal and if the patient is rotated half way to the left, its course through the posterior mediastinum may be studied.

### Examination of the Stomach.

As the meal reaches the cardiac orifice, firm pressure is made over the left hypogastrium and in this way the fundus is distended and further progress is temporarily delayed. The complete contour of the

fundus is seen by rotating the patient alternately to left and right, the pressure meanwhile being maintained. When the pressure is released, the body of the stomach is filled and its contour is viewed in a similar manner.

A true conception of the arrangement of the rugæ of the stomach is gained by a manoeuvre aptly described by Scott as "white-washing" the walls of the stomach. Firm manual massage over the body of the stomach results in approximation of the anterior and the posterior walls at the site of pressure; this results in displacement of the bulk of the opaque medium from this area, only traces remaining in the folds of the rugæ. In a normal stomach the rugæ are represented roughly as parallel curves and any material departure from this arrangement may be a useful guide to the demonstration of a pathological condition. A stellate distribution of the rugæ is seen when an ulcer is present, scar contraction causing this radiating appearance from the site of the lesion. In carcinoma of the stomach the rugæ are absent over the site of the neoplasm. Gentle palpation is of great service in the elucidation of many gastro-duodenal conditions; peristalsis is increased both in frequency and depth of the waves and the tendency is for the pylorus to relax.

Rough massage gives rise to artefacts and misconceptions owing to the irregular and abnormal peristalsis induced and the various spasms which are likely to occur. Hence it is necessary that all manipulations of the abdomen should be carried out in an intelligent and gentle manner.

Peristalsis of the stomach is an important function which receives special attention in the fluoroscopic examination. Normally a peristaltic wave has its origin high up on the greater curvature where many similar ripples are seen progressing downwards towards the body of the stomach. During their passage several of these wavelets fuse to form a larger indentation on the greater curvature. This traverses the body of the stomach, gradually increasing in depth as it progresses and being accompanied by a smaller but increasing indentation on the lesser curvature. By the time such a wave has reached the proximal portion of the pyloric antrum, both curvatures are deeply indented and the stomach is divided into two separate compartments. The smaller and distal compartment then is distended with stomach contents and evacuation through the pylorus is effected by relaxation of the pyloric sphincter, followed by concentric contraction of the walls of the pyloric antrum, resembling the action of cardiac muscle in systole.<sup>(4)</sup>

Such is the *modus operandi* in a normal J-shaped stomach, through which the peristaltic waves pass at intervals of about ten seconds, each wave occupying about twenty seconds in its passage. As a rule not more than two waves are seen passing through the stomach at the one time and a definite increase to four or more denotes the condition of hyperperistalsis. In this condition not only are the waves increased in number, but also in depth and in both curvatures there are equal indentations.

In the "steer-horn" variety of stomach evacuation is effected by the passage of an ordinary peristaltic



wave to the pylorus, relaxation of the pylorus occurring as the wave of dilatation arrives preceding the wave of contraction.

#### Examination of the Duodenum.

It is in the examination of the first stage of the duodenum that fluoroscopy and palpation are of greatest service to diagnosis. The duodenal cap is not as a rule seen in the distended state on a radiogram, for, as the meal is forced through the pylorus into the duodenal cap, its further passage is unimpeded by any constriction of the lumen of the duodenum and only slight peristaltic effort is then necessary on the part of the duodenum to propel its contents further on.

Palpation of the stomach has already stimulated active peristalsis in that viscus and the meal is forced into the duodenum with each wave. Complete distension of the cap is obtained by exerting pressure over the descending part of the duodenum, thus temporarily arresting progress. In this way the contour of the cap may be examined completely and any irregularity noted. "White-washing" of the walls of the cap serves to demonstrate the presence of a fleck due to an ulcer and this manipulation may contribute valuable information. When the cap is distended, the fleck is hidden from view and it is visible only when the walls of the cap are approximated by manual pressure. In this way the contents of the cap are expressed and the barium-filled ulcer crater is seen as a dense black fleck. A niche can be recognized only when the cap is distended and it appears then as a small projection from the normal limits of the cap. It is necessary to rotate the patient into that position in which the affected portion of the duodenal wall forms part of the outline of the cap.

Frequently it is difficult to visualize the duodenal cap in obese patients, especially when the stomach is of the "steer-horn" variety. Carman described a method of obtaining a satisfactory view in such cases: "The patient places his right hand on his left shoulder, brings his left arm forwards and turns towards the right into the lateral position or slightly beyond. The bulbar shadow is thus projected towards the examiner's right."<sup>(1)</sup>

#### GASTRIC ULCER.

Ulcers of the stomach are rare compared with similar lesions in the duodenum. Gastric ulcers predominate in women, whilst duodenal ulcers are more commonly found in men. There seems to be no rational explanation for this discrimination between sexes.

A comparison of the anamneses typical of the two varieties is interesting. The woman with gastric ulcer appears ill and complains of many symptoms which have been present probably for years. The robust man of healthy appearance, on the other hand, is almost apologetic that he has sought medical advice at all. He makes light of his "indigestion" which is intermittent. He may be troubled by it for several weeks and for the succeeding three months he feels perfectly well. But on one or two occasions he has been frightened by an attack of severe abdominal pain, following which his friends have

noticed that he is pallid in appearance and perhaps he himself has noticed the passing of tarry motions on days succeeding the attack. Such is the type of man in whom duodenal ulcer is frequently found.

It is probable that few gastric ulcers go undetected by radiological examination. The signs are as a rule positive and as the crater usually erodes one or two layers of the stomach wall, its presence can be demonstrated as a barium-filled pouch projecting from the normal stomach outline; even if such positive evidence is wanting, there is generally some indirect evidence if a lesion is present.

#### Radiological Signs of Gastric Ulcer.

##### Direct.

*Niche.*—The niche is the infallible radiological sign of gastric ulcer. The size of the niche is a reliable indication of the extent of the ulcer crater. A useful classification of gastric ulcer for purposes of radiology includes three types: (i) The mucous type which involves only the mucosa and thus possesses a very shallow crater which when filled with barium forms a very small projection on the shadow of the stomach. (ii) The penetrating type in which the sub-mucosa and muscularis have been invaded. The niche then corresponds to a more extensive and deeper portion of the stomach wall and hence the projection is more marked; it is roughly triangular in shape, the base of the triangle adjoining the normal stomach outline. (iii) The chronic perforating type, which erodes all layers of the stomach wall; the crater forms an accessory pocket outside the stomach bounded by granulation and fibrous tissue and it may invade adjacent organs, such as the lower surface of the liver or the pancreas. In this variety the niche may be large and the accessory pocket holds its barium content for a considerable time after the stomach has emptied itself.

*The Fleck.*—In ulcers in which the raw area is small, and in which erosion of the stomach layers is inconsiderable, a niche may not be seen and this is the type in which the "white-washing" manoeuvre is helpful. Barium emulsion adheres to the raw area and when the stomach walls are approximated by pressure a dense spot or fleck is seen at the site of the ulcer. The fleck may be seen repeatedly in the same position and the rugæ in its neighbourhood diverge in a stellate manner. Such abnormal arrangement of the rugæ is a result of scar contraction around the ulcer. The fleck sign may be the only positive evidence of a small ulcer, but even in the large varieties it should be elicited as confirmation of the presence of a niche.

##### Indirect.

*Incisura.*—In almost every case of gastric ulcer a spasmodic *incisura* occurs on the greater curvature of the stomach directly opposite the ulcer. It is usually a narrow and deep indentation and it may produce the condition of pseudo-hour-glass stomach. In small ulcers with little scarring the *incisura* is purely spasmodic in origin, but when ring contraction has occurred in the stomach wall, the lumen of the stomach may be permanently divided into two compartments by a band of fibrous tissue, producing the true hour-glass stomach. A purely spasmodic



*incisura* disappears under anæsthesia, so that at operation it is not present, but antispasmodic drugs do not usually cause a relaxation of the spasm.

**Tenderness.**—Tenderness on pressure over an ulcer is a sign of little significance, but it may indicate to the examiner the site of a small niche or fleck.

**The cross-bar symptom.**—Fraenkel<sup>(5)</sup> has described a new sign, the cross-bar symptom, for the detection of early lesions of the stomach, either simple ulcer or carcinoma, and he employs Röntgen kinography to demonstrate it. Several films are taken during the course of one peristaltic wave through the stomach; the outlines of the stomach are superimposed one on the other and thus a wave of peristalsis is seen in several phases. Normally the stomach outlines, when plotted in this way form a series of curves which cross one another at regular intervals, but when the cross-bar sign is present, the curves are condensed over a limited area into a single straight line. Fraenkel describes this symptom as "the cessation of peristalsis on the lesser curvature at the site of an ulcer; the length of cessation is always the same, about eight millimetres and the block intrudes into the peristalsis like a cross-bar. It signifies a segmental function alteration of the transverse musculature."

The symptom may be detected on the fluorescent screen if the amplitude of the peristaltic wave is considerable, but the kinographic method is preferable.

From Fraenkel's description it would appear that this sign will prove an important feature in the radiological diagnosis of early gastric lesions and as it seems possible to recognize carcinoma of the stomach in its earliest stages, a thorough investigation of the method is surely warranted.

#### Site of Gastric Ulcers.

The middle third of the lesser curvature is the most frequent site for an ulcer of the stomach. The niche appears then in the radiogram taken in the antero-posterior position as a projection from the lesser curvature. Lesions in such positions are readily recognized.

Ulcers arising from the anterior or posterior surfaces of the stomach are more difficult to detect. Ordinary radiograms taken in the standard antero-posterior position show no evidence of their presence and it is only when the patient is rotated into such a position that the involved surface forms part of the stomach outline, that their presence is known.

Fluoroscopy is thus the means by which it is possible to localize an ulcer, and indicates the position in which the patient must be placed in order that a radiogram of the lesion may be obtained.

The greater curvature of the stomach is a most unusual situation for a gastric ulcer and the demonstration of a real niche on a border which is normally irregular must always be difficult. Blaine reported three cases of simple, penetrating ulcer of the greater curvature diagnosed radiologically. In only one case was operative confirmation obtained, but he described the appearances in all three as being identical.<sup>(6)</sup>

The pylorus is a common site for peptic ulceration and the radiological recognition of an ulcer in this region is easy if the crater is of appreciable size.

Fixation of an ulcer to surrounding structures is demonstrable usually on the fluorescent screen, an ulcer on the posterior wall adherent to the pancreas being the most common. The area including and immediately surrounding the ulcer is seen to be stationary during respiratory movements and the same area is immobile on palpation.

Narrowing of the pyloric canal from whatever cause results in varying degrees of delay in emptying of the stomach and this constitutes an indirect sign of value in establishing the diagnosis.

Extreme degree of stenosis which has been developing over a number of years, results in dilatation of the stomach and the shadow of fluid within it may be seen before the opaque meal is given. This indicates that the fluid ingested probably more than twelve hours prior to the examination is retained within its lumen. Hypotony and even atony is the rule in such cases, the meal forming a meniscus in the dependent portion of the stomach.

Peristalsis of the stomach in cases of pyloric stenosis is characteristic. After a preliminary latent period lasting for several minutes during which no peristalsis is seen, a succession of well-formed and deep waves passes towards the pylorus. Little or none of the meal is forced through the pylorus by this preliminary muscular effort and some of the waves after reaching the pylorus are seen to return through the stomach as reverse peristaltic waves. Eventually when the spasm relaxes, small quantities of meal are squirted through the narrow channel with the arrival of each wave.

The pathological changes associated with gastric ulcer give rise to changes in the radiological appearance of the stomach which are characteristic, and the chief among these are the ulcer crater and scar contraction.

#### DIVERTICULA OF THE STOMACH.

Although uncommon in occurrence it is important that a diverticulum should be differentiated from ulcer. In both conditions a niche is seen, but writers on the subject have evolved a reliable method of differentiation. It is interesting to note *en passant* that gastric symptoms are not usually complained of in cases of diverticulum of the stomach. The upper portion of the lesser curvature just below the cardiac orifice of the stomach is the characteristic situation of a diverticulum.

#### Pathology.

According to Keith the musculature in the stomach is weak around the œsophageal orifice, so that increased intragastric pressure may give rise to a bulging in this situation. All coats of the stomach are involved and the lining of the pouch is normal gastric mucous membrane. The condition is always acquired, there being no evidence to suggest that it is a congenital abnormality. That increased intragastric pressure plays an important part in the ætiology is exemplified in a case reported by Hurst.<sup>(8)</sup> The condition was detected in a woman who had been subject to pernicious vomiting

in three successive pregnancies each of which had been prematurely terminated for that reason.

#### Radiological Appearances.

The diverticulum forms a round shadow often surmounted by a gas bubble. It is usually about the size of a cherry and is sometimes pedunculated, the connecting channel between the lumina of the diverticulum and the stomach appearing as a stalk.

The regular outline and circular shape of the niche are characteristic and when these appearances are associated with free mobility of the shadow, the diagnosis of diverticulum is almost certain. Mobility is tested mainly by movements during respiration, for the position of the lesion high in the stomach under the left costal margin does not allow of manipulation by palpation. There is usually no tenderness on pressure over a diverticulum, a factor of minor significance, again due to the inaccessibility of the lesion. A diverticulum once filled with opaque fluid may retain it for a considerable time. Hurst reports a case in which the pouch remained filled with barium for seventy-two hours after it was ingested.

#### DUODENAL ULCER.

It is only since 1900 when Weir<sup>(3)</sup> analysed the literature and reported his own experiences, that duodenal ulcer has been recognized as a definite pathological lesion, although in 1887 Osler remarked that "the solitary ulcer occurs more frequently in the duodenum than in any other part of the intestine."<sup>(4)</sup>

Records of the Mayo Clinic for a period of several years show that among each hundred cases of gastric or duodenal disease the incidence of duodenal ulcer is fifty-six cases, gastric ulcer six, gastric and duodenal ulcer combined one and gastric cancer twelve.<sup>(5)</sup> Such statistics indicate the frequency with which duodenal ulcer occurs, and the importance of possessing a reliable method of diagnosis; for in the majority of cases of duodenal ulcer surgical treatment is indicated and an accurate diagnosis is of great service to the surgeon.

The proportion of duodenal to gastric ulcers found in Australia is probably greater than that quoted from the Mayo Clinic in America. In a small series of sixty-three cases seen in Adelaide during the last eighteen months, in all of which a radiological diagnosis of duodenal or gastric ulcer was made, the proportion was found to be fifty-six duodenal to seven gastric ulcers. Thirty-four patients were operated on for duodenal and five for gastric ulcer and confirmation of the diagnosis was obtained in thirty-one and five respectively.

#### Site.

The first portion of the duodenum, called the duodenal cap, is the usual site of ulceration. Carman asserts that nine-tenths of all duodenal ulcers are found within five centimetres (two inches) of the pylorus. It is fortunate that it is so, for the recognition of small abnormalities in contour of the duodenum beyond the cap presents difficulties, owing to the presence in the second and third portions of *valvulae conniventes* which convert the shadow of

the lumen of these portions into an irregular band of feathery appearance.

#### Appearances of Duodenal Ulcer.

##### Pathological Appearances.

The naked eye characteristics of the ulcer and of that portion of the duodenum in its immediate neighbourhood are of importance to the radiologist. Pathological changes produced in the wall of the duodenum are faithfully portrayed in the shadow seen on the fluorescent screen. Hence the actual size of the ulcer crater, the appearance of an accessory pocket of the chronic perforating type and the extent of cicatricial contraction are pathological factors of special interest.

The crater is usually shallower in duodenal than in gastric ulcer owing to the difference in character of the mucous membrane and "sometimes the actual ulcer is a mere slit or dimple surrounded by an eroded discoloured patch of mucosa."<sup>(10)</sup> At operation it is felt as a depression in a thickened area of the wall of the duodenum.

Scar contraction may involve a comparatively large area surrounding the ulcer; it alters the contour of the cap and partially obliterates its lumen.

##### Radiological Appearances.

Correlation of the pathological and radiological appearances of duodenal ulcers has provided a rational explanation of many of the abnormalities detected during radiological examination. Hence a niche corresponds exactly to the crater of an ulcer. Gross deformity of the cap is usually due to scar contraction, but there is one important radiological sign which has no counterpart in the pathological specimen, namely the spasmodic *incisura*. This is seen radiologically in almost every duodenal ulcer as a deep and generally narrow indentation in one border of the cap, constant in size and position and unaffected by the administration of antispasmodic drugs. It is actually an important radiological sign in the diagnosis and yet at operation there is no evidence of its presence. It is purely a secondary manifestation and disappears under anaesthesia, a fact which reconciles the apparent discrepancy in pathological and radiological appearances.

Where a niche is visible, it is usual to find an *incisura* exactly opposite and this combination reproduces the classical radiological picture of duodenal ulcer. Such a picture is seen only when the cap is fully distended. A partially filled cap may at any time have appearances suggestive of an *incisura* or niche or of both, but it is only when these signs have been detected on many successive occasions when the cap is distended, that they are recognized as *bona fide* entities.

#### Radiological Signs of Duodenal Ulcer.

##### I. Direct:

1. Niche.
2. *Incisura*, (a) organic, (b) spasmodic.

##### II. Indirect:

1. Hyperperistalsis of the duodenum.
2. Hyperperistalsis of the stomach.
3. Hypermotility of stomach followed by slow rate of emptying.

4. Hypermotility of the colon.
5. Tenderness on pressure over the duodenal cap.

#### Direct.

The method of detecting the presence of a niche and *incisura* has been described. In all radiograms in which a niche is observed in one plane, the presence of a central fleck should be tested in the plane at right angles. This is done by approximating the walls of the duodenum to display the dense fleck of the barium-filled ulcer crater.

The duodenal niche has been described by many writers in recent years. Åkerlund published the result of a series of examinations in which he asserts that he found a niche in 50% or 60% of all duodenal ulcer. This percentage is high when compared with the result of other careful observers; Carman claims the detection of a niche in 13.2% only of a series of 1,658 duodenal ulcer seen radiologically during the year 1925.<sup>(1)</sup> He considered, however, that the finding of a niche justifies opening the duodenum, if necessary, to determine the presence or absence of an ulcer.

#### Indirect.

A combination of several of the indirect signs may justify a diagnosis of duodenal ulcer, but considered singly they are of slight significance.

Evident hyperperistalsis of the stomach associated with an irritable state of the duodenum with frequent regurgitation from the second to the first stage forms a fairly reliable combination.

For the rest tenderness on pressure over the duodenum is of variable occurrence and hypermotility of the colon is often associated with duodenal ulcer, but appears to have no appreciable significance.

Hence the radiological diagnosis of duodenal ulcer depends mainly on the finding of one or both of the direct signs and provided that careful observation is made, the great majority of diagnoses should be found to be correct at operation. Organic lesions in tissues adjacent to the duodenum may give rise to radiological signs similar to those of ulcer. Pathological conditions of the gall bladder are frequently associated with such reflex signs and an *incisura* is often found with a diseased gall bladder. The differential diagnosis in such cases is sometimes impossible from the radiological examination alone, but the sign is almost invariably associated with a pathological lesion in the immediate vicinity of the duodenum and hence the failure to localize the absolute site of the lesion is of small consequence.

#### ASSOCIATION OF GASTRIC AND DUODENAL ULCER.

Carman states<sup>(3)</sup> that in 11.5% of patients with gastric ulcers, there is a coexisting duodenal ulcer. This fact imposes the necessity of a thorough routine examination of both stomach and duodenum in every case.

The following case which is probably unique, illustrates the result of coexisting gastric and duodenal lesions:—

A man, *etatis* about forty years, had suffered from symptoms suggestive of gastric ulcer for six years. He had had two hæmatemeses, one four years before and the second two years before coming under observation. The first

hæmatemesis was followed by symptoms suggestive of progressive pyloric stenosis. The second hæmatemesis resulted in complete relief of these symptoms and he then complained of indefinite digestive symptoms.

Radiological examination revealed complete occlusion of the pylorus and base of duodenal cap. There was an anastomotic connexion between the middle third of the lesser curvature of the stomach and the terminal portion of the duodenal cap. A large niche was seen around the site of the anastomosis. There was irregularity of the duodenum adjoining the stomach. Peristalsis in the stomach proceeded to the pylorus and returned as reverse peristalsis to the site of anastomosis, whence the stomach evacuated its contents. A residue of a quarter of the meal was found in the pyloric end of stomach twenty-four hours after ingestion.

The diagnosis was pyloro-duodenal ulcer followed by complete stenosis; a large chronic perforating ulcer of the lesser curvature through which a fistulous connexion between stomach and duodenum had formed. At the operation the assumption of a fistulous connexion between stomach and duodenum was confirmed. The pylorus and the base of the duodenal cap were represented by a fibrous cord. There was ulceration in the duodenum just beyond the site of the anastomosis. Anterior gastro-jejunostomy was performed; technical difficulties contraindicated the posterior operation. The patient was under the care of Mr. F. D. Saner, Honorary Surgeon, Royal Northern Hospital, London, who performed the operation, and by the courtesy of whom the operative findings are here recorded.

It seems certain that gastro-jejunostomy is the best treatment for most cases of duodenal ulcer and especially for those patients whose stomach is of the J-shaped variety. A hypertonic stomach of the steer-horn variety is often considered to be a contraindication of the operation.

The following case illustrates some of the misfortunes which may follow surgical treatment of duodenal ulcer, even when the condition is apparently amenable to surgical treatment:—

A man, *etatis* about thirty-three years, was operated on primarily for acute ruptured duodenal ulcer. The perforation was closed, but the condition of the patient did not allow of further operative interference at the time. About one month subsequently posterior gastro-jejunostomy was performed. Freedom from symptoms lasted for some months, but after that period he again complained of abdominal pain and discomfort. At the third operation a jejunal ulcer was found adjacent to the stoma. The gastro-jejunostomy was closed and the jejunal ulcer infolded; as the duodenal ulcer was still present, gastro-duodenostomy was performed. This man came up for radiological examination in October, 1926, about twelve months after the third operation. The examination revealed gastro-duodenostomy functioning moderately well, a well marked niche in the pouch of the cap above the site of anastomosis, a dilated loop of jejunum, one limb of which was narrow suggesting the site of the jejunal ulcer.

On October 25, 1926, operation was performed by Mr. Simpson Newland, by the courtesy of whom I was present. Resection of the pyloric end of stomach and duodenum including the gastro-duodenostomy and duodenal ulcer was carried out; suture of the duodenum and anterior gastro-jejunostomy was then performed. The anterior operation was deemed advisable on account of the presence of adhesions in the lesser sac.

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- <sup>(2)</sup> Colombier: "An Opaque Food," *British Journal of Radiology*, May, 1926.
- <sup>(3)</sup> Russell D. Carman: "Roentgen Diagnosis of Diseases of the Alimentary Canal," Second Edition, page 30.



<sup>(4)</sup> E. D. McCrae, B. A. McSwiney, J. M. W. Morison and J. S. B. Stopford: "Normal Movements of Stomach," *The Quarterly Journal of Pathology*, October, 1924.

<sup>(5)</sup> S. Fraenkel: "The Cross Bar Symptom," *British Journal of Radiology*, September, 1926.

<sup>(6)</sup> E. S. Blaine: "Simple Penetrating Ulcer of the Greater Curvature of the Stomach," *American Journal of Roentgenology and Radium Therapy*, July, 1925.

<sup>(7)</sup> Irving Gray: "Diverticulum of Stomach," *American Journal of Roentgenology and Radium Therapy*, August, 1925.

<sup>(8)</sup> A. F. Hurst: "Diverticula of Stomach," *British Journal of Radiology*, January, 1925.

<sup>(9)</sup> Harvey Cushing: "Sir William Osler," Volume I, page 286.

<sup>(10)</sup> W. J. Mayo: "Chronic Duodenal Ulcer," *Journal of the American Medical Association*, June 19, 1915, page 2036.

DR. S. S. ARGYLE (Melbourne) exhibited a number of films dealing with the following bone conditions: von Perthes's disease with segmentation of the femoral head, Paget's disease with changes in the skull and commencing changes in the spine and slight thickening of the cortex of femur and tibia; a very early case of abscess in the femur, hydatid of the humerus, a hip joint condition which appeared very like a monarticular osteoarthritis, but which was healed, a tuberculous condition which had been active eight years previously and an undiagnosed condition. He discussed a case of a perfectly healthy man who in six weeks had become acutely ill and very dyspnoic; a skiagram of the lungs displayed what might have been taken for advanced tuberculosis. The sputum did not contain tubercle bacilli; but a pure culture of streptothrix had been obtained. The lungs cleared up rapidly on the administration of potassium iodide. This case was discussed to illustrate the necessity of a full clinical history of every patient sent to the radiologist.

MONDAY AFTERNOON, FEBRUARY 7, 1927.

COMBINED MEETING, SECTIONS IX AND XII.

PULMONARY TUBERCULOSIS IN YOUNG CHILDREN.

By G. J. BLACKMORE, M.D., D.P.H.,  
Medical Director, Tuberculosis Institutions  
of North Canterbury.

It is not possible in the space of twenty minutes to deal in any way adequately with such a big subject as pulmonary tuberculosis. But I am merely opening a discussion on the subject and I hope other speakers will make good my deficiencies.

There is rather a tendency for us to deal with tuberculosis in watertight compartments, as if tuberculosis in the lungs, kidneys, bones and other structures were separate and distinct diseases, whereas, of course, they are all merely manifestations of the one disease. If we wish to understand the various manifestations of tuberculosis, we must keep clearly in mind the truth that tuberculosis is not a local disease but a systemic one, that no matter where the principal lesion may be nor how much it may appear to be localized, the whole body is affected by the bacillus and its products.

A consideration, then, of tuberculosis in any one organ must of necessity involve some consideration of tuberculosis as a whole.

As a rule we do not actually know where or by what means the tubercle bacillus gains an entrance to the body or what happens to it up to the time of the formation of the tubercle, but from a mass of

contradictory evidence we may adopt the following as a working hypothesis which is subscribed to by many observers. I mention it chiefly because it has a bearing on the prevention and very early treatment of tuberculosis.

The germs having entered the body are ingested by the polynuclear leucocytes and in the body of the leucocytes may circulate in the body for a long time. If the bacilli are not destroyed by the polynuclear cells or eliminated in the secretions, mainly biliary and intestinal, the leucocytes are eventually poisoned and degenerate. The *débris* of the bacilli are then taken up by the mononuclear leucocytes and if these cannot destroy the bacilli, they unite to form a giant cell enclosing the bacilli and so the tubercle is produced. In that way we have infection becoming actual disease, but it is not yet active disease and may never become so. It may remain latent in the glands or other parts for years or even for life. The tubercle may not caseate or if it does, the caseated material may be absorbed and be replaced by a calcareous mass or it may be walled in by a fibrous wall. It is not until the caseated material breaks down and becomes distributed that we have active disease in the body.

As the lymphatic glands are packed with leucocytes, it is usual for us to find in the glands the first effects of a tuberculous infection; in fact, it may be said that in most cases tuberculosis is primarily a disease of the lymphatic system. The glands themselves act not only as filters, but they also produce enzymes which may destroy the bacilli. The lymph glands have frequently been found to contain tubercle bacilli when there has not been any sign of disease either in the glands themselves or in any organ in the body. The tubercle bacillus has thus usually to pierce a triple line of defence before it gains a footing, namely the polynuclear and the mononuclear leucocytes and the lymph glands. A fact that seems to be definitely proved is that the infection of tuberculosis takes place in the great majority of cases in childhood and that caseating pulmonary tuberculosis is the terminal stage of that childhood infection.

This being the case, we should not expect to find much evidence of active tuberculous disease in the lungs of young children excepting in cases of miliary or acute rapidly-spreading tuberculosis and this is actually the condition of affairs. Active pulmonary tuberculosis is not very common in young children. Of 1,800 patients admitted to the Cashmere Sanatorium at Christchurch only thirty-seven were below thirteen years of age. In saying that lung tuberculosis is not very common in children I am referring to tuberculosis which gives clinical evidence of its presence, because *post mortem* evidence shows that lesions are extremely common in the lungs of quite young children suffering from tuberculosis, but these lesions usually give no evidence of their presence by clinical signs.

As regards the diagnosis and treatment of pulmonary tuberculosis in children, it is not necessary for me to deal in detail with points which you can find much better dealt with in any text book. But there are just a few points on which I should like to



lay stress. First of all, the family history. We may take it that practically all cases of lung tuberculosis in children as well as in adults are due to human infection. All the evidence available seems to point to the fact that infection in nearly all cases takes place indoors. That being the case, it is to the child's home that we must pay the greatest attention and to infection amongst members of the household or other dwellers in the home. From hospital records it is estimated that something like 52% of tuberculosis patients give a family history of tuberculosis. I am convinced that this is a gross underestimate. I have devoted much time to the obtaining of family histories from persons suffering from tuberculosis and have by patient inquiry elicited a history pointing definitely to familial infection in large numbers of persons from whom in the first place the simple inquiry as to whether there was any history of tuberculosis in the family, had met with the definite response: "None whatever."

Believing as I do that the child is nearly always infected in its own home, it follows that great attention should be paid to the family history and also to exposure to infection by other persons than immediate relatives during childhood.

As regards personal history, great importance should be attached to a history of pleurisy, dry or wet. Nearly all cases of pleurisy are undoubtedly of tuberculous origin.

A history of spitting of blood is most suggestive. Bleeding from the gums must always be excluded. In these days of the cult of the toothbrush, bleeding from the gums is very common.

Due attention must be paid to loss of weight, loss of energy and loss of appetite, also to a history of frequent colds. Inquiry will generally elicit the fact that these so-called colds are not ordinary colds at all. What really happens is that frequently the child has a cough which persists for some considerable time. When there is a history of cough, spitting of blood and loss of weight, the presence of tuberculosis in the lungs is almost certain. I have, however, met with hydatid disease in children in whom just these signs were present.

It is not necessary for me to dwell on the ordinary physical signs of lung tuberculosis; but there is one sign which, when present, should at once suggest tuberculosis to the mind, not necessarily pulmonary disease or even actual disease at all, but tuberculous infection. That sign is the presence of numerous, small, palpable glands in the triangles above the clavicles in front and in the triangles behind the neck. These glands are usually shotty in character and may be very small. I am not referring to the fairly large, discrete glands, perhaps two or three in number, often found in the necks of children with unhealthy gums or throats. The glands referred to are numerous. Very frequently they are to be found also in the axillary regions and I have a suspicion that if we could only get at them we should find some enlargement of practically all the glands in the body, which, if true, seems to suggest that wherever the point of entry may be the defensive

forces of the whole glandular system are called into play to deal with the invader.

A diagnostic measure of very great importance is the use of tuberculin. In young children infection, when present, can be proved by the use of von Pirquet's or Moro's test. Neither test, however, does more than indicate that infection has taken place. The lesion may be quite quiescent in spite of a positive reaction. To prove the presence of active disease in the lungs, it is necessary to make use of hypodermic injections of Koch's Old Tuberculin. A reaction which is both systemic and focal, shows the presence of active disease.

I do not need to say much about hilum tuberculosis. Dispute is still taking place as to whether there must be a lung lesion before the glands become diseased, as stated by Parrot and Ghôn, or whether the mediastinal and tracheo-bronchial glands are always first infected, as stated by others. It is certain that the mediastinal and tracheo-bronchial glands are frequently diseased and that still more frequently they contain tubercle bacilli, without there being any sign of disease in them. The clinical diagnosis of hilum tuberculosis is one beset with the greatest difficulties. By percussion, auscultation and the use of X rays we may possibly be able to detect enlargement of the glands at the root of the lungs, but this does not prove the presence of tuberculosis; the enlargement is usually a matter of conjecture. Signs that are sometimes considered to indicate enlargement of the group of glands, are an oval-shaped area of percussion dullness in the interscapular space especially on the right side and d'Espine's sign, which is the transmission of the whispered voice when the stethoscope is placed over certain of the dorsal spines. Whereas normally the whispered voice is not heard below the first dorsal at the age of eight years, below the second dorsal at twelve and below the third dorsal at fifteen, if swollen glands are present the whispered voice can be heard to the seventh dorsal spine. Both signs are very fallible. As regards the use of X rays in the diagnosis of hilum and pulmonary tuberculosis, we have some hundreds of chest radiograms taken by ourselves at the Cashmere Sanatorium and although I have made a careful study of these and many others side by side with a record of the clinical signs and with radiograms of healthy lungs, I must confess I am still in doubt regarding the correct interpretation of many of the appearances on the X ray film. I understand that some of the radiologists present will give their views on X ray examination of the lungs.

#### Prophylaxis.

I do not propose to say anything about the treatment of lung tuberculosis in children. It follows accepted lines. But I am anxious to say something about the prevention of tuberculosis in children and the measures that should be taken to prevent infection from developing into active disease which to a large extent means the development of pulmonary tuberculosis.

Tuberculosis being a disease of childhood, if we want to get rid of it, we must concentrate our efforts to a large extent on the child. Paul Latesse, in a report to the League of Nations on tuberculosis in Europe, published six months ago, says: "Infection in infancy is the crux of the whole tuberculosis problem" and that is undoubtedly true. The dispensaries in Lausanne, Switzerland, give special attention to infants and tuberculous meningitis has become rare in the district where it used to be very prevalent.

To help in preventing surgical tuberculosis we must have a pure milk supply. It is said that it would not pay to kill tuberculous cows. It does not pay not to kill them. Judging by the way in which milk is still allowed to distribute tuberculosis among children, most members of our legislature and of our local bodies consider that the life of a tuberculous cow is of more value than the life of a child. It is a fact that many of us give milk to our children which the careful dairyman would not give to his pigs.

Assuming the view to be correct that nearly all children are infected in their own homes, usually by one or other parent, it is obvious that we must either remove the children of tuberculous parents from those parents soon after birth or we must do something to immunize the children against infection. To remove a child from its mother, even when that mother is tuberculous, is easier said than done. It is a brutal and heartless way out of a difficulty. Can we then immunize children against tuberculosis? The only method so far put forward which seems to hold out any promise of success, is Calmette's and nothing very definite can yet be said about it.

Calmette, by growing tubercle bacilli in a medium containing ox-bile and reculturing for thirteen years, succeeded in producing a strain of tubercle bacilli which he claims is absolutely non-toxic and yet when given to children by the mouth confers immunity against attack by virulent bacilli. Three doses of ten milligrammes of bacilli in a teaspoonful of milk are given to the children of tuberculous parents within ten days of birth. It is claimed that this confers immunity, but for how long is not yet known.

Many years' experience of many infallible methods for the prevention and treatment of tuberculosis, all of which "have had their day and ceased to be," have taught me to be extremely cautious about accepting the opinions of even eminent men regarding the effects of their own remedies. Calmette's figures regarding tuberculosis in France certainly do not apply to New Zealand. He makes the statement that of all the children born in France of tuberculous mothers over 25% die of tuberculosis in the first year of life.

Professor Calmette very kindly sent me two cultures of his bacillus Calmette-Guérin (B.C.G.). One culture died on the voyage. The other I handed to Dr. Pearson, the Bacteriologist at the Christchurch Hospital, whose aid I have enlisted and with some difficulty he succeeded in obtaining fresh cultures.

We propose to test these on guinea pigs and, if possible, on calves, both as regards the toxicity of the cultures and their immunizing action.

Although Calmette's tests appear impressive, some evidence not in favour of the method is already forthcoming. Heymans vaccinated guinea-pigs with Calmette's bacilli and on being tested all the animals developed and died of tuberculosis but they lived twice as long as the control animals which had not been vaccinated.

Assuming that immunization against tuberculosis is not yet within the sphere of practical politics, can we, when infection has taken place, do anything to prevent that infection from becoming actual disease? I think we can do very much.

The position at present is that we know or can find out that infection has taken place, that it is being held in check by the defensive forces of the body and that those forces, when unable by themselves to overcome the invader definitely, require in all probability only a little outside help to enable them to do so. Knowing these things, we sit down and wait for the infection to become a destructive disease in adolescence or early adult life and then try to stem its progress. This is a foolish and disastrous policy. Should we not, instead of pursuing a policy of masterly inactivity, definitely attack and try to expel the invader while his footing is still insecure, instead of allowing him time to marshal his forces and overrun most of the country before we take action?

On the Cashmere Hills in Christchurch, in connexion with the sanatorium, we have established a fresh air home for the children of tuberculous parents. By von Pirquet's or Moro's test I have definitely established the fact that in nearly all cases these children have been infected with tuberculosis. Those who have escaped infection, are pitifully few in number. We are there making a determined attempt to prevent the infection of those children from becoming actual disease. Some of the children have a terrible family history. For instance in one family of five children the father is dead of tuberculosis, the mother is in the last stages; the father had ten brothers and sisters, all but two are dead of the disease; his father, grandfather, uncles and aunts, nearly all slain by this ruthless enemy; the children are all infected. With that family history the end is sure unless something is done to prevent it. To fight with that enemy in order to release the stranglehold he has obtained on that unfortunate family and to try and save those children, seems to me a fight that is worth while.

The children in the home live in the open air night and day; they have physical exercises designed to make the whole body fit, but particular attention is paid to the development of the lungs and the strengthening of the heart; they receive good food of the proper kind; they are made to take adequate rest; twice daily, for an hour each time, the whole body is exposed to the sun in order to take full advantage of the prophylactic action of sunlight against tuberculosis and lastly, but by no means least, the children receive tuberculin. As you all

know, tuberculin has no protective influence against infection, but it has a powerful detuberculating action when infection has taken place and raises the resistance of the body in most cases to a marked extent. The tuberculin is given by means of Moro's tuberculin ointment, a small portion of which is well rubbed into the skin once a week. The first ointment used contains 10% tuberculin, the next 20%, the third 35% and the fourth 50%. Sir Robert Philip, the eminent Edinburgh specialist, is the man to whom the credit is due for emphasizing the detuberculating action of this ointment.

The children are kept in the home for seldom less than eighteen months; many remain much longer. The results so far have been all that could be desired. The numbers are too small and the time too short to allow of any conclusion being formed as to the ultimate result, but personally I am convinced we are on the right lines and that if homes of this kind could be multiplied in New Zealand so that the children of all tuberculous parents could be dealt with, the results in the next generation in the way of diminution of tuberculosis would be found to justify the measure.

But we are not waiting for those homes to be built, because much can be done without them. A few months since the Director of School Hygiene wrote stating that it was proposed to test the children in the State schools by means of von Pirquet's test, to find out what the incidence of tuberculous infection among the children is. She asked what I thought of the proposal. I warmly commended it, but recommended the use of Moro's ointment instead of von Pirquet's test, as the latter involves scratching the skin, a procedure which might cause objections to be raised by some parents. I also pointed out that when infection has been discovered, the matter should not end there; treatment should at once be begun by means of the same ointment in an attempt to detuberculate the child. At the same time arrangements should be made to teach the children under open-air conditions; the parents should be advised of the infection and they should be given advice regarding sleeping out of doors, the proper food to be given and the need for adequate rest.

The suggestion was at once adopted. The School Medical Officer at Christchurch held some meetings of parents to explain the scheme and she told me that she was simply "snowed under" with requests from parents to have their children tested. If the method of testing and treatment can be brought into use throughout New Zealand and the infected children be kept under surveillance until they grow up, then we shall, I think, have made the greatest national attack against tuberculosis that has yet been made.

In conclusion, I put forward the following propositions:

1. Tuberculosis is essentially a disease contracted in childhood; the adult is relatively immune to infection; the disease which shows itself in adult life, is in the great majority of cases a recrudescence of a disease contracted in childhood.

2. Infection takes place almost entirely indoors. It is, therefore, the home conditions during childhood with which we must deal if infection is to be prevented.

3. It is with the child that we must deal if we wish to prevent the infection from becoming a serious disease and if we wish to abolish adult tuberculosis. Even if the scheme I have outlined is not adopted; I still think that we should do something definite to try and prevent these infected children from dying of their disease and infecting others later on in life. We are not, I think, playing our part as members of the profession to which the public looks for help against disease, if we sit down with folded hands and allow this great enemy of our race to work his will unchecked among the children of the community.

#### PULMONARY TUBERCULOSIS IN CHILDREN

By H. W. PALMER, M.B., Ch.M.,  
Medical Superintendent, Waterfall Sanatorium,  
New South Wales.

If it were true that children are more susceptible to pulmonary tuberculosis than adults or when affected the disease is more rapidly fatal, one would expect to find the death rate higher for this age. In the Australian Commonwealth out of a total of 1,769 deaths from pulmonary tuberculosis in 1925 only thirty-one deaths occurred in children under fourteen years.

The experimental evidence of resistance to tuberculosis in young animals is scanty and inconclusive, but Arvid Wallgren<sup>(1)</sup> inoculated forty-five rabbits of varying ages with tubercle bacilli and found that the very young ones were certainly not less resistant than older ones, but that those at the age of puberty died first.

#### Resistance of the Child to Infection.

A well formed child at birth has a good chance of developing, even if his mother is suffering from open tuberculosis, provided his surroundings are good. In Paris the Grancher method of treating such children<sup>(2)</sup> is to remove them from their mothers soon after birth to healthy country homes. Over a period of seventeen years 2,300 such children were dealt with and only seven developed tuberculosis.

However, to leave such children in these homes is most risky. Usveldt<sup>(3)</sup> found that of 480 such children in tuberculous families 37.7% died when the mother was tuberculous, 19.7% when the father and 18.1% when the brother or the sister was affected.

These figures are European, but they show the danger.

Owing to the patency of the lymphatics infection has every chance of gaining entry into the child and given that the infecting bacilli are virulent, the dosage massive and the opportunity of infection frequent, what chance has anyone of resisting? All these conditions exist when a child lives with a person suffering from open tuberculosis. That so many children survive under such conditions infers



high resisting powers. They will succumb only when their resistance has been broken down.

The type of bacilli infecting the lungs in children is the human type<sup>(4)</sup> and according to Aschoff<sup>(5)</sup> and Ghon<sup>(6)</sup> the primary site of infection is in the lungs.

Aschoff demonstrated that the primary forms of tuberculous infection occur in the air spaces of the lungs and that the infection of the lymphatics occurs later. Ghon considers that primary tuberculous infection takes place in the lung parenchyma and that the main route of entry is by the inhalation and the regional lymphatic glands are infected through tubercle bacilli entering through the lung lymphatics. The pulmonary lymphatics consist of a superficial and a deep bronchial system which Chadwick showed were closely connected and converge at the hilum. As all drainage of the lungs is through the tracheo-bronchial glands, entry of large numbers of tubercle bacilli into the lymphatics may occur, blocking these passages with a local infection. Hence the danger of a massive infection apart from any virulence.

The effect of a primary tuberculous infection upon the resistance of the individual to subsequent reinfection is most important. Aschoff has shown that the primary focus causes changes in the tissue reactions, so that secondary infections are localized, an inflammatory reaction occurs, but the tubercle bacilli are fixed locally. This primary infection may be so slight as to be quickly reabsorbed. Trudeau, Krause and others also admit similar results from the primary infection. Tuberculous lesions may heal up and disappear, may calcify or end in caseation.

Gardner, Harms and others have shown that tuberculous foci in children can clear up completely with no recurrence of the disease. On the other hand calcification does not mean necessarily the death of all the tubercle bacilli, so that reinfection may occur with calcification as with caseation. Wollstein found in infants that the tissues failed to wall off the tubercle infection, while with the older children as with adults the secondary tuberculous foci were encapsulated.

From the foregoing, one would naturally expect to find differences between the signs and symptoms of tuberculosis among infants and among adults. The infantile type of pulmonary tuberculosis differs from the adult type in rarely affecting the apex, but occurring as small irregular foci scattered throughout the lower lobes or affecting the hilum and is more exudative in character.

Age of the child largely determines the acuteness of the infection. That tuberculosis is so often acute with children under two years of age, is probably due to the failure to wall off the tubercle infection. With these children there is often much wasting, objection to food, irritability, weakness and fatigue. The temperature may be high, the pulse rapid and the breathing distressed. Cough may be at first slight, while the physical signs in the chest are those of an exudative broncho-pneumonia.

As the child passes the second year, the tendency is for hilum tuberculosis to develop or for the

broncho-pneumonic forms to become more chronic or latent. As a rule it is not till the child nears puberty that the adult type of disease appears, though it may appear in the first year. An infantile type may occur at any age, probably due to the absence of primary infection when young, as with the American negro among whom latent hilum tuberculosis is rare.

Hilum tuberculosis is probably the commonest form during the age period from two to ten years and at Lymanhurst Sanatorium 1,412 children under twelve years all of whom had suffered from exposure to tuberculosis, were examined by X rays. In 946 the hilum showed calcified patches, while in 53 the bronchial glands were calcified. A primary focus was found in 231. Although X ray shadows by no means prove a tuberculous stigma, these figures must mean a considerable amount of infection.

#### Symptoms.

Symptoms of the meningeal or miliary type may develop like acute fevers, but at first there may be only failure to grow normally; refusal of food, irritability and pallor are common, fever may not be severe, cough if present is slight, but does not clear up. Pleurisy is dry, while bleeding, night sweats and sputum are rare in the young. Later wasting and more acute signs occur, as prostration, dyspnoea, cyanosis and persistent cough.

Of physical signs at first there may be only lagging of the side affected in inspiration with diminished expansion, paravertebral dullness, lessening of resonance, weakening of puerile breathing, fleeting crepitations posteriorly, while later all the signs of pneumonia and broncho-pneumonia may occur, even to cavitation.<sup>(6)</sup>

#### Diagnosis.

The diagnosis is easy only if tubercle bacilli are found and if sputum is available, thorough search should be made. In a series of 126 children under the age of twelve years at Waterfall Sanatorium sixty-one had sputum and in forty-one tubercle bacilli were found. Faeces should also be examined for tubercle bacilli. In the absence of tubercle bacilli reliance must be based on all the available evidence. Family history, presence of enlarged glands and radiographic signs are important, but not conclusive. Broncho-pneumonia that does not clear up, is suggestive, especially if the relapses occur at the original sites.

Tuberculin for diagnosis is not without danger, and are not the only substances that cause typical reactions in tuberculous persons, for sodium morrhuate, influenza serum, horse serum and egg albumin may cause typical reactions, while "Sanocrysin" is said to do the same.

Again for diagnosis the first dose must be the optimum dose to cause a reaction, for a weaker dose, while not causing a reaction, sensitizes the tissues, so that on giving a second injection, a reaction may be obtained in a person not suffering from tuberculosis. Calmette's eye tests proved this, for when the eye tests failed to react, an injection of old tuberculin caused serious reactions in the eye. Tuberculin also causes reactions in other diseases.



Measles, whooping cough, sarcoma may give typical reactions, while tuberculin often fails to give reactions in persons suffering with active tuberculosis.

Von Pirquet's test is admittedly unreliable, yet it is still used. If tissues deeper than the skin cuticle are scratched and blood is drawn, the fluid used to dilute the tuberculin will give a typical reaction. At Waterfall Sanatorium eleven hundred patients and later five hundred patients were tested by von Pirquet's method and only 38.4% and 38.6% reacted. Of those who reacted, 52% had acute disease and 48% had chronic disease.

The results with children were exactly the same. If it is true that 90% of the general public react, what reliance can be placed on it as a diagnostic agent.

Treatment for acute conditions is that for bronchopneumonia and later similar to the treatment for adults. Supervision, however, must be stricter and continued for years, not only to prevent any relapse, but also to correct the diagnosis and any abnormalities, to build up resistance and if possible to carry them over the period of puberty. Children can be allowed much more exercise than adults and they do remarkably well at sanatoria or "preventoriums."

Waterfall Sanatorium has had one hundred and twenty-six children under treatment more than five weeks. The disease in eighty-five was arrested, fifteen of the patients were improved and one unimproved, while only four died. There are still twenty-one children under treatment.

Preventive treatment must eliminate risk and increase the individual's resistance to infection. Under no circumstance whatever should a child till well past puberty be exposed to any chance of a virulent or massive infection. Either the child or the infected person should be removed. Where home conditions are bad, the Grancher method could be used. In Chicago it is illegal for any person suffering with open tuberculosis to remain in contact with children under the age of sixteen years. In 1924 of 908 such persons only thirty-three had to be removed forcibly.

The health authorities must insist on hygienic standards in the homes. Every child must have good food, fresh air, abundance of sunlight; it must be watched that it develops normally and all irregularities are corrected. When the child goes to school, cooperation with the school medical officers should make the previous supervision more complete. Class rooms should be of the open air or open window type and when the child is ill nourished, milk could be supplied, as is done in some schools.

Milk instead of being a factor in tuberculosis infection, is more likely to be our natural immunizing agent. In Vienna and India little milk is drunk, while in Japan and the Shetland Islands the cattle are free from tuberculosis, yet tuberculosis is rampant among these people.

When judged by the result of tuberculin testing in the human subject, the wholesale testing of dairy cattle is wasteful and futile. Any danger to the community can be prevented by pasteurization; only diseased cattle need be destroyed.

#### Artificial Immunity.

Nathan Raw, Friedmann and now Calmette have tried to develop an attenuated strain of the tubercle germ which when taken into the body, will cause no injury, but will give immunity against tuberculous infection. Calmette claims good results with new born children, but many points have to be settled before his claims can be accepted. In the present state of our knowledge, such an immunizing agent may be found at any time. Till such an agent is found, we should enforce notification, supervision and separation of children from the sources of tuberculous infection. Pasteurization of milk should also be compulsory. Supervision must be efficient medical supervision till the child is past puberty and all abnormalities corrected.

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- (4) J. A. Watt: "Pulmonary Tuberculosis in Childhood," *The Lancet*, December 27, 1924, page 1327.
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- (6) A. Ghon: "Primary Lung Focus of Tuberculosis in Children."
- (7) D. M. Siperstein and H. Bauguess: "Cavitation in Children," *American Journal of Diseases of Children*, 1925.

#### PULMONARY INTRATHORACIC TUBERCULOSIS IN CHILDREN

By C. C. ANDERSON, M.B., Ch.B. (New Zealand),  
D.M.R.E. (Liverpool),  
Radiologist, Dunedin Hospital.

THE state of our knowledge of the conditions found in early intrathoracic tuberculosis both in adults and infants is so chaotic and ill-defined that it was thought that a combined meeting on this subject would bring forth some information which would be of value both to pædiatrists and to radiologists.

When I first began to examine children's chests radiographically I was led astray by comparing the appearances noted with those seen in adult chests and undue stress was laid on mottling which subsequently appeared due to non-pathological processes. There is no doubt that the early changes of pulmonary tuberculosis can be shown once the tubercles begin to form, but the difficulty is to know how to distinguish the early pathological appearances from the normal or average chest.

In regard to the available literature Barjon, Rotch and Walker Overend were not very helpful. They all laid particular stress on broncho-adenopathy in the five to fifteen years period, whereas I have noted very few cases of this type amongst our patients, the majority within this period being more of the adult type. Ribadeau-Dumas, Weil and Maingot (1912) by means of instantaneous radiography demonstrated that lesions commence in infants and very young children usually in the lower

lobe and spread centripetally to the hilum. This work has been confirmed in part by the pathological observations of Ghon (1913) which prove that in children the primary focus may occur in any part of the lung.

Up to the present I have not been able to carry out instantaneous radiography in children, but up to a point I feel that primary pulmonary invasion usually occurs in this area, though it is quite an easy matter to get infection of the hilar glands by lymphatic spread from infected cervical glands. In my experience the miliary type is rare.

Normally the root shadows which are due principally to the shadows of the blood vessels, appear as two crescents separated slightly from the median shadow by a narrow clear space, the lower horn of the crescent being more elongated and prolonged obliquely downward and outwards. Any infection of the hilar glands will reveal itself by an alteration in the shape of these shadows and by obliteration of the narrow clear space.

In consideration of the following cases I shall commence with clinical histories of patients proved subsequently to be normal; they will illustrate the difficulties of this examination.

I have here two skiagrams. The first patient is a boy aged four and a half years who was sent down to the X Ray Department with a diagnosis of tuberculous peritonitis. Certainly the clinical findings were in support of this. Screening revealed a distinctly raised diaphragm, suggestive of peritoneal fluid accompanied as you can see by considerable mottling of both lungs. Three days later the child died, came to *post mortem* examination and was found to have been affected by Banti's disease. Dr. D'Ath who performed the autopsy, was unable to find any abnormality which would account for these shadows. I have a skiagram of another patient; the picture has a similar appearance. This patient was discharged well after splenectomy. The second patient, a girl aged seven, in spite of pronounced mottlings in the lungs failed to react to the von Pirquet test, so that tuberculosis can be excluded. In any case the clinical findings were not very definite.

These cases serve to show our difficulty in this respect and the great difficulties that present themselves in distinguishing between the juvenile and adult chest affections.

The next patient, a girl aged six, also came to *post mortem* examination. The skiagram reveals a circumscribed shadow at the base of the right lung with a small collection of air in the upper part. It is evidently a breaking down tuberculous focus. Note the density of the shadows of the left root.

The fourth patient, aged twelve, was referred by his physician on account of bronchitis. He did not appear particularly ill, but as you can see in the skiagram there were advanced changes of the adult type. The extraordinary thing about this child was the good state of his general health. A prolonged rest in the country caused a great improvement in his condition, but the X ray appearances underwent no change. The child continues to keep well in spite of the apparently advanced lesion in his chest. In

a recent skiagram no obvious change beyond the appearance of a cavity at the right apex is seen, yet the boy, though possibly somewhat smaller than normal, is playing games like a normal healthy boy of his age.

The fifth patient, a boy aged eight, comes of a tuberculous family. Nearly every member of the family has been through my hands. You will notice at the left root a dense triangular shadow with an irregular edge. This child was observed for many months without any change being noted. Suddenly a short time ago he had pleurisy; the whole of the left hemithorax was filled with fluid.

The following cases are typical of the difficulties that beset the radiologist. The boy, aged five, the younger, was sent with a definite diagnosis of pulmonary tuberculosis and yet apart from the decreased air entry at the right apex there is very little difference between the findings in his case and those in the first and second patients. His sister, a year older, was referred previously as a suspect. Here again the radiographic appearances are very similar with the exception that there is a chain of dense shadows leading from the top of the right root outwards to the base, undoubtedly delineating caseated tuberculous foci. It is not possible to say from the skiagram whether these foci are still active, but it is probable that she has infected her younger brother.

The eighth patient, a much older child, eleven years, presents a different aspect again, but her condition more closely approximates the adult type. There is definite consolidation at the left apex and this is accompanied by much fine mottling spread throughout both lungs and the root shadows are, of course, greatly increased indicating glandular infection. It is not possible exactly to determine the site of original infection as there are no particularly dense shadows which would indicate that an old focus had lit up.

In the ninth patient a further type again occurring in young children is seen. This child is four years of age and gave a history of constantly recurring broncho-pneumonia. The hilar glands are obviously much enlarged and there are numerous patches of consolidation scattered throughout both lungs. It is quite possible that he has a simple broncho-pneumonia, but he probably also has a definite tuberculous diathesis and if not carefully looked after will shortly develop a frank tuberculous infection.

The tenth patient is also a young child. Here the root shadows are definitely enlarged and of a type to suggest bronchial adenopathy such as is described by writers in the old world.

The last two patients also have signs of bronchial adenopathy and are both girls. The elder of the two, aged eleven, has the typically enlarged hilar glands, but on the left side the tuberculous process has spread beyond the gland capsule and has actually invaded the lung which is consolidated for some distance from the hilum. The type of consolidation is quite different from that seen in ordinary pneumonia.

ILLUSTRATIONS TO THE ARTICLE BY DR. H. R. SEAR.



FIGURE I.  
Irregularity at pyloric canal, possibly juxta-pyloric ulcer, possibly duodenal ulcer.  
C = crater of ulcer.  
D.C. = duodenal cap.



FIGURE II.  
Juxta-pyloric ulcer; crater well seen.

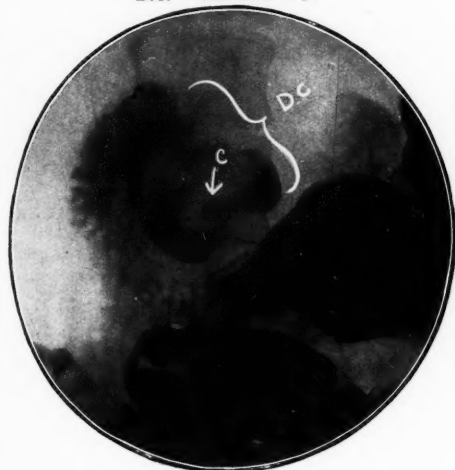


FIGURE III.  
Crater of ulcer (C) showing through partially emptied cap.

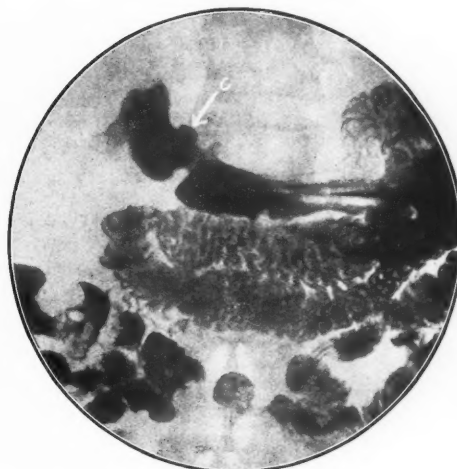


FIGURE IV.  
Duodenal ulcer showing crater (C).

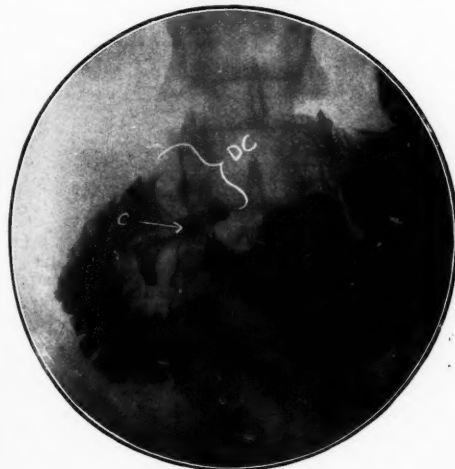


FIGURE V.  
Duodenal ulcer. D.C. = duodenal cap.  
C = crater.

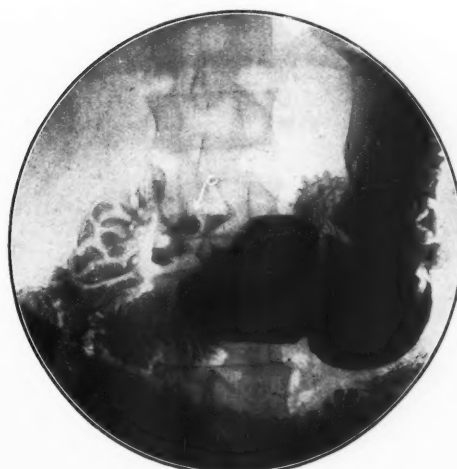


FIGURE VI.  
Duodenal ulcer. C = crater.

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FIGURE VII.  
Chronic ulcer of duodenum, with pseudo-diverticulum (F.D.). D.C. = duodenal cap.



FIGURE VIII.  
Chronic ulcer of duodenum—crater on greater curvature border. Very rare.

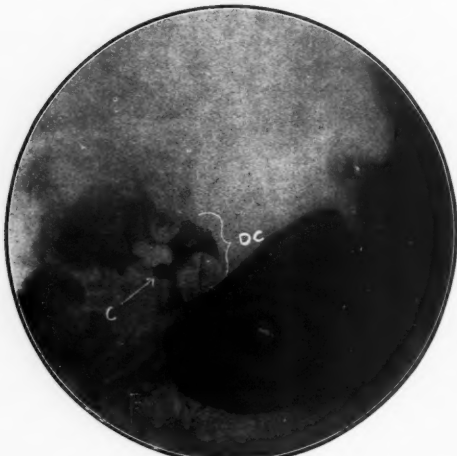


FIGURE IX.  
Duodenal ulcer. C = crater on greater curvature border.



FIGURE X.  
Duodenal ulcer. C = small crater.



FIGURE XI.  
Duodenal ulcer, showing irregularity due to spasm.



FIGURE XII.  
Gastric ulcer (G.U.) and duodenal ulcer. C = crater.



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FIGURE XIII.  
Deformity of the cap due to adhesions.  
D.C. = duodenal cap.  
C.H. = calcified hydatids.



FIGURE XIV.  
Congenital adhesions of duodenum.



FIGURE XV.  
Adhesions hitching up duodenal loop at A

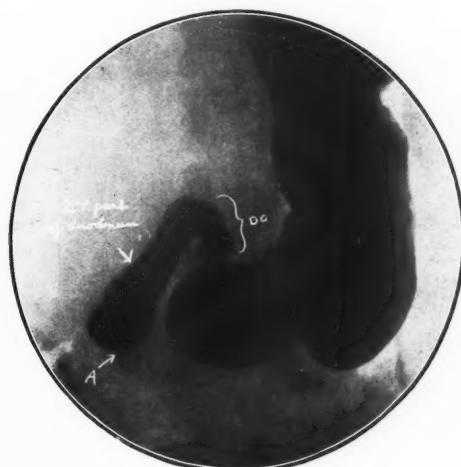


FIGURE XVI.  
Adhesions causing partial obstruction in second part of duodenum.



FIGURE XVII.—Duodenal ileus.



FIGURE XVIII.  
Carcinoma of fourth part of duodenum, causing pressure defect on lesser curvature of the stomach.

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FIGURE XIX.  
Enlargement of duodenal loop due to pancreatic new growth.



FIGURE XX.  
Pancreatic new growth pressing on stomach and simulating carcinoma of stomach.



FIGURE XXI.  
Pedunculated growth of duodenum.



FIGURE XXII.  
Large congenital diverticulum of duodenum.  
D.D. = diverticulum.  
D.C. = duodenal cap.



FIGURE XXIII.  
Congenital duodenal diverticulum filled twenty-four hours after opaque meal.



FIGURE XXIV.  
Small diverticulum of duodenum.

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FIGURE XXV.  
Huge duodenal diverticulum.



FIGURE XXVI.  
*Linitus plastica* and duodenal diverticulum.



FIGURE XXVII.  
Cholelithiasis with pseudo-diverticulum (P.D.) due to irregular peristalsis. G.S. = gall stones.



FIGURE XXVIII.  
FIGURE XXVIII.—Same patient as Figure XXVII. Pseudo-diverticulum now disappeared. P.D. represents dilated duodenum due to irregular peristalsis.

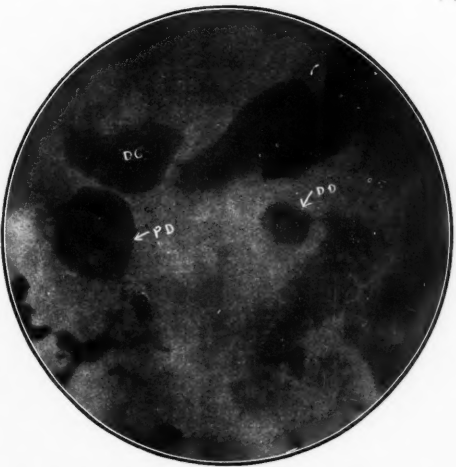


FIGURE XXIX.  
True duodenal diverticulum (D.D.) with pseudo-diverticulum (P.D.) due to irregular peristalsis.



FIGURE XXX.  
Barium filled gall bladder.



ILLUSTRATIONS TO THE ARTICLE BY DR. S. HARRY HARRIS.

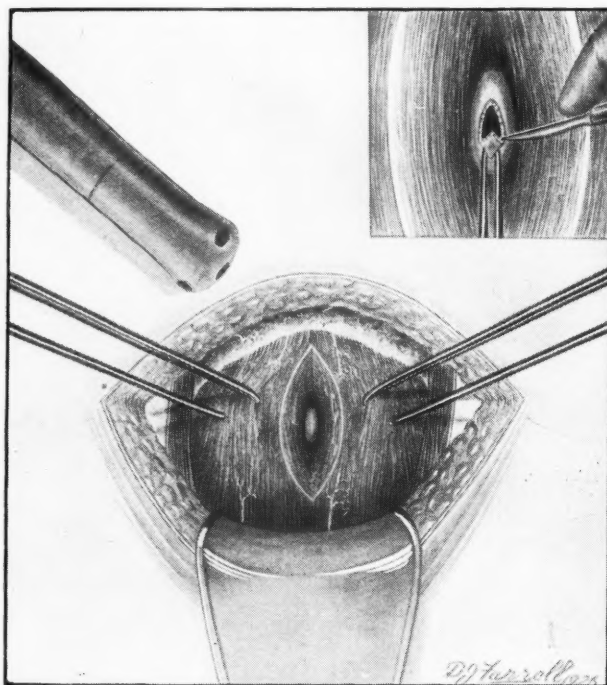


FIGURE I.  
Layer dissection of bladder. Nozzle of "sucker"  
ready for insertion. Inset: Method of cutting  
mucosa (enlarged).

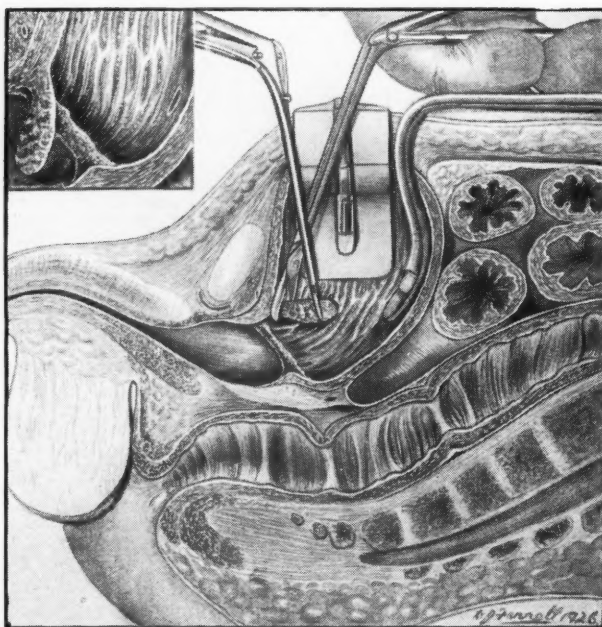


FIGURE II.  
Sectional view: Removal from anterior region of  
sphincter of adenomatous nodule discovered during  
systematic review of prostatic cavity after  
prostatectomy. Inset: Enlarged view of nodule  
in natural position.

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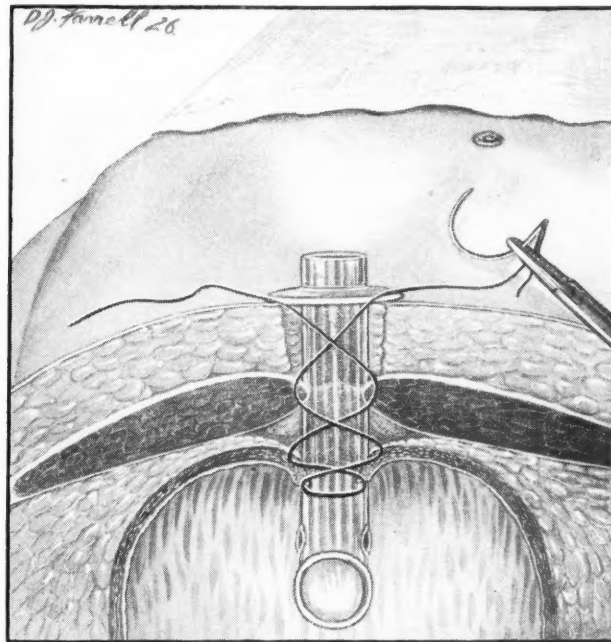


FIGURE III.  
The single extended figure-of-eight suture  
used for wound closure before it has been tied.

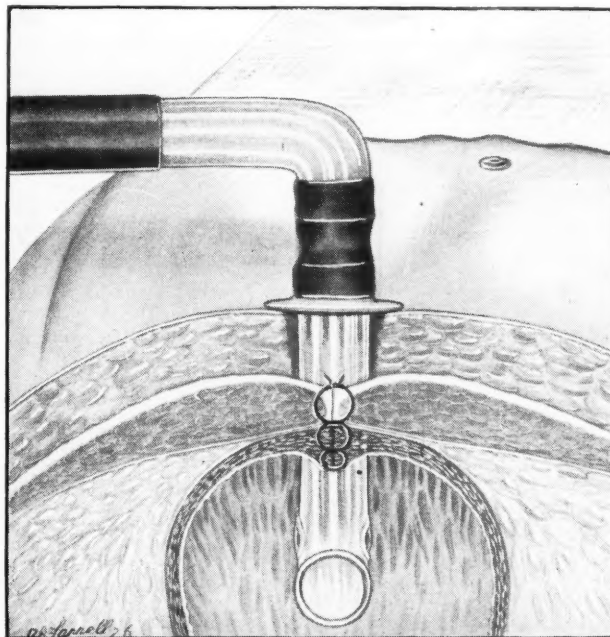


FIGURE IV.  
The suture drawn tight and tied. The glass  
bladder drainage tube of two centimetres (three-  
quarter inch) calibre in position. Operation  
complete.

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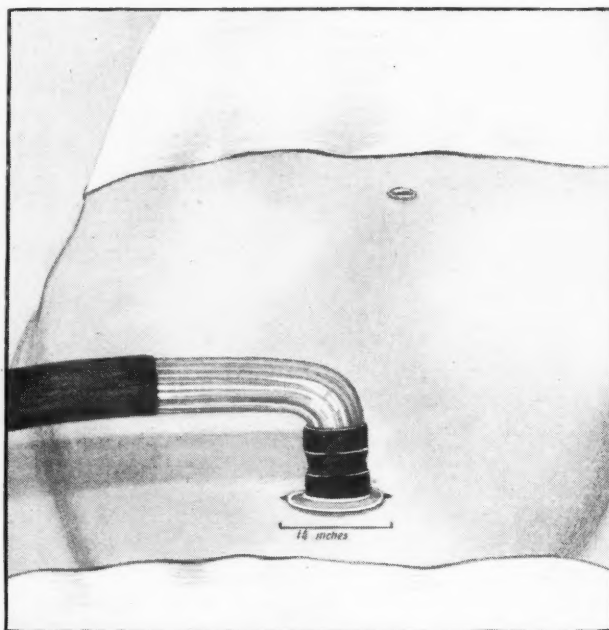


FIGURE V.  
Operation completed through a thirty-two millimetre  
(one and a quarter inch) incision which the tube  
snugly fills. No skin sutures required.

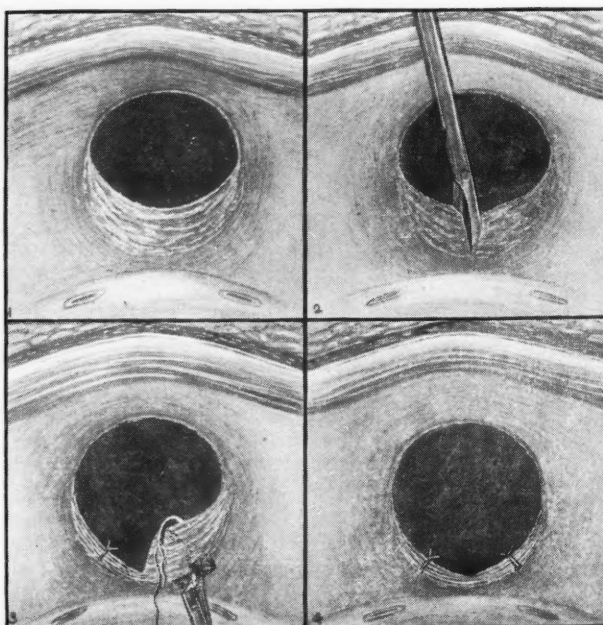


FIGURE VI.  
Redundant tissue in trigonal region after prostatectomy,  
showing method of bisection and suture.



ILLUSTRATIONS TO THE ARTICLE BY DR. H. BONAR LINDSAY.



FIGURE I.

The patient had lost two babies after very difficult labours. The antero-posterior diameter at the brim measured 8.45 centimetres and the transverse 11.4 centimetres. Pubiotomy was performed. A normal labour of six and a half hours' duration followed. The child weighed 3,232 grammes. The skiagram was taken four years later.

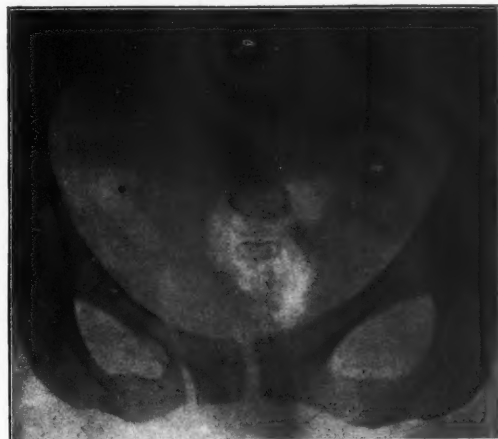


FIGURE II.

The patient had lost her two previous babies, one from eclampsia and the other through craniotomy. The antero-posterior diameter was approximately 9 centimetres. Pubiotomy was performed and the labour was normal.

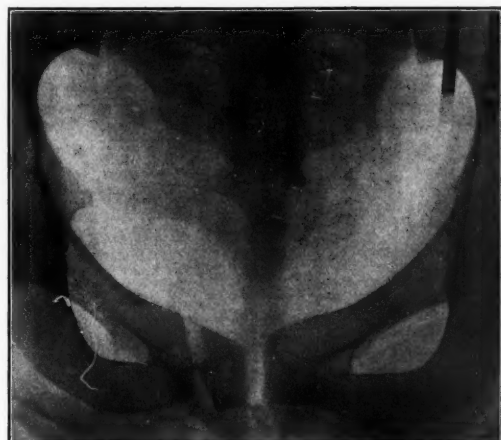


FIGURE III.

The head would not enter the pelvis at the thirty-eighth week. The antero-posterior diameter was 9 centimetres and the transverse was 12 centimetres. Pubiotomy was performed and the baby was born before aid could be given in the ward four days later. It weighed 3,061 grammes. The skiagram was taken six weeks after delivery.



FIGURE IV.

The first child was delivered with great difficulty and was macerated. The antero-posterior diameter was 8.8 centimetres and the transverse 11.3 centimetres. Pubiotomy was performed and the delivery was effected with forceps on the following day. The child weighed 3,175 grammes.

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FIGURE V.

Skiagram taken nine months after labour, showing non-union of the bones. (Same patient as in Figure IV.)

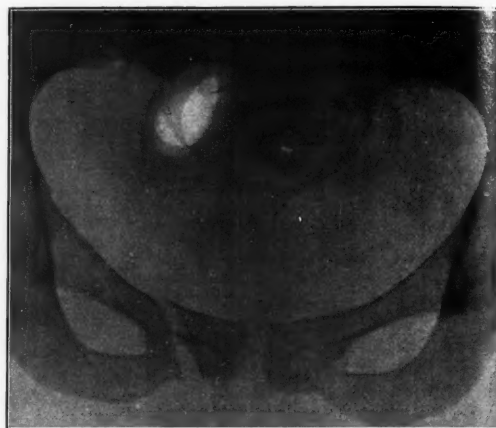


FIGURE VI.

The patient lost her first baby, weighing 4,082 grammes, after a difficult forceps delivery. The antero-posterior measurement was 9.5 centimetres and the transverse 11 centimetres. Pubiotomy was performed at the fifth month. The labour was normal and lasted five hours. The weight of the child was 4,483 grammes. The skiagram was taken before delivery.

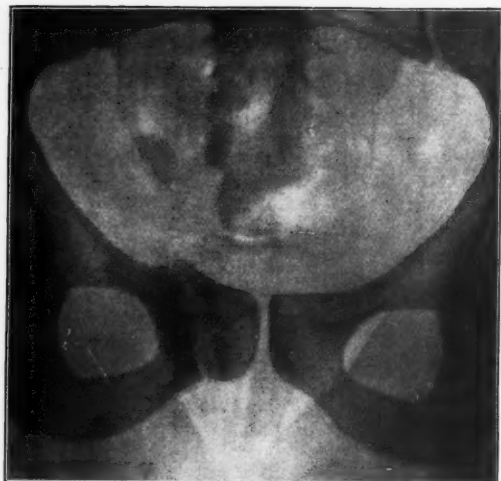


FIGURE VII.

The first child had been lost through craniotomy; it weighed 3,743 grammes. The antero-posterior diameter was 8.5 centimetres and the transverse 12.5 centimetres. Pubiotomy was performed on September 28 and labour was completed with forceps on November 16, 1926. The child weighed 3,628 grammes. The skiagram was taken three months after the operation and shows union of the bones.

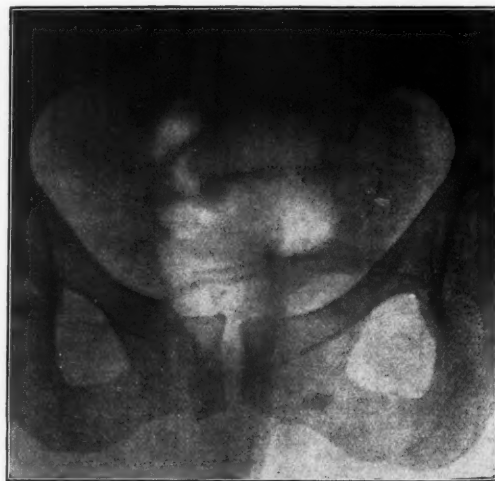


FIGURE VIII.

The patient has two living children who were born after great difficulty. The antero-posterior diameter was 10 centimetres. An obstructed labour was diagnosed as due to a right occipito-posterior presentation. The head rotated, but forceps were ineffective. Pubiotomy was performed and forceps were still ineffective. The delivery was completed after perforation and extraction. The child weighed 3,402 grammes. The skiagram was taken fourteen days after delivery.

The last patient, aged nine, who came with a history of hæmoptysis, also presents enlarged hilar glands, but in addition there is much peri-bronchial infiltration of the adult type; in fact, the whole picture is such as we would expect to find in a patient twenty years older.

These few cases will serve to show how many and diversified are the types of infection that are encountered in children and indicate some of our difficulties in arriving at a diagnosis. In considering the prevalence of tuberculosis in a country like New Zealand, one is struck by the acuteness of the infection in older children and adults, so different from the more chronic course of the disease in the old world. In view of this fact it is quite reasonable to suppose that the radiographic findings will be somewhat different from those seen in lands where living conditions are worse than our own.

DR. T. MCKIBBIN (Wellington) in opening the discussion said that the point which concerned hygiene most was bovine tuberculosis; it was still under consideration. The bacteriologist held that there was a clear demarcation between bovine and human tuberculosis. In England about 30% of deaths from tuberculosis were bovine in origin. In New Zealand dairy experts held that tuberculosis was lessening among herds; clean milk was, however, still important in prevention. It should be an easy matter to test whether milk was clean; for example, milk could be taken from the supply and injected into guinea pigs and rabbits. It could then be seen whether any tuberculosis was present.

DR. BRUTON SWEET (Auckland) said that bovine tuberculosis was of great importance in infancy and childhood. He held that a great percentage of tuberculosis was bovine in origin, more so than was usually given in the figures of investigators. He was convinced that the majority of young children were infected through milk. He raised the question of how prevention could be carried out. Was it by sterilizing milk effectively? Home pasteurizing for ten minutes was insufficient to kill tubercle bacilli as in humanized milk prepared in the home. In England, although Grade A milk was tuberculin tested, in hospitals Grade A milk was boiled before use. He uttered a warning against milk.

DR. C. E. W. LYTH (Dunedin) pointed out that he had found in Dunedin a number of cases of bone and joint disease in children whose parents, one or both, were tuberculous. He stated that a great percentage of surgical tuberculosis in children was human in origin, at least around Dunedin. He held that the von Pirquet test was not dependable. He had used Moro's ointment to a certain extent in children who had been contacts, but the reaction was very uneven. He questioned whether it was a percutaneous or subcutaneous method. In Australia dry pleurisy had been pointed out as common in children. In New Zealand pleurisy with effusion was more in evidence.

PROFESSOR C. E. HERCUS (Dunedin) referring to the amount of bovine tuberculosis said that surmise was no good; experience and trial only were to be relied on. In Dunedin all material sent in had been investigated. All pulmonary tuberculosis had been found to be human; regarding bone and joint tuberculosis more samples were needed for investigation. He agreed with Dr. Palmer in his attitude concerning tuberculin, but disagreed as to the unreliability of the von Pirquet test; a reactor usually harboured a lesion. The tuberculin reaction was not a filter separating the vulnerable to tuberculosis from the invulnerable. It was of value in diagnosis. The tuberculin reaction was an anaphylactic reaction, the antigen being the tubercle bacillus. He would rather fall into the reactor group than into the non-reactor group, for the former was already immunized towards tuberculosis. Some of his best students had yielded strong reactions, a measure for congratulation. The non-reactors should be dealt with

and immunized against tuberculosis, not the reactors as in Moro ointment investigations. It was better to proceed on the above lines than to sterilize milk and protect the baby. Let the baby and the child protect itself by making its own immune bodies by means of a sublethal dose. In regard to milk he pointed out that 60° C. for twenty minutes certainly killed tubercle bacilli. He thought that the bacillus of Calmette-Guérin might be one day given as a routine vaccination against tuberculosis, a hopeful measure for the future.

DR. HARVEY SUTTON (Sydney) stated that while school examinations revealed tuberculosis in the schools, some might be missed in the homes. Out of 75,000, twenty-five had pulmonary tuberculosis according to recent school figures. Of these 50% had pulmonary tuberculosis in the home. He was firmly convinced that the massive dose must be avoided. The problem was to deal with the open case, the patient with a chronic type of tuberculosis, who returned to his family to infect his children by means of the massive dose. The Federal Government recommended paying the family compensation while the father was kept away until cured.

In regard to bovine tuberculosis he personally recommended the drinking of fresh milk. He had had many samples examined in Australia and had not found tubercle bacilli, but he believed in tuberculin testing of herds. Bovine tuberculosis certainly was a problem in connexion with children under the age of five years. In the prophylactic measures quoted in the papers read 1,200 reactors had been treated in the schools. He considered 1,200 non-reactors should also have been treated as controls. He agreed with Dr. Hercus that the Moro method was not the best, but he thought that it should be tried. He would prefer to see a direct attack on malnutrition in children. The school was the starting place for early adult tuberculosis. Children must be taught hygiene and brought up to a good physical standard. He was afraid of the alarmist attitude of detuberculizing children as a whole.

DR. JEFFERIS TURNER (Brisbane) considered that slight infection of children in childhood was not harmful but beneficial, immunity being established. Heavy infection—the massive dose—was certainly harmful. He wondered if the children of the open air home quoted by Dr. Blackmore were improved by the Moro inunction or by the régime of the home, the open air and sunlight. He considered that control should have been used.

DR. Blackmore in reply said that great differences of opinion had been expressed during the discussion. The question would have to be decided by each person for himself. In answer to Dr. Hercus he pointed out that the most modern work showed that a patient with pulmonary tuberculosis with cavitation died as a result of his immunity.

DR. Palmer in reply said that it was hard to tell when the response to the von Pirquet test was specific. Active and chronic tuberculosis were not differentiated by the test. Regarding bovine tuberculosis all cows reacting to the test were not suffering from active tuberculosis and it was only cows with active lesions which should be destroyed. Sterilizing milk was a protective measure. Boiled milk with a little orange juice was an adequate and safe food.

## SECTION II.—SURGERY.

### SUPRAPUBIC PROSTATECTOMY: COMPLETE EXPOSURE THROUGH A ONE AND A QUARTER TO ONE AND A HALF INCH INCISION: OPERATIVE RESULTS AND TECHNIQUE.

By S. HARRY HARRIS, M.D., Ch.M. (Sydney),  
Honorary Urologist, Lewisham Hospital, Sydney.

SUPRAPUBIC prostatectomy since its wide popularization by Freyer has been the subject of endless discussion. At different times and in different clinics innumerable variations and modifications of technique have come and gone. In the past most of



the operations have been more or less of a blind nature, being performed entirely by touch, unaided by vision. Latterly the trend has been decidedly towards the performance of an "open" operation, the field being more or less completely visualized. The very wide incisions practised by some surgeons both at home and abroad admit almost a complete daylight exposure.

Were it the sole desideratum, this wide exposure would doubtless be the choice of most operators. Many other factors, however, must be taken into account, of which the most important are: (i) primary wound union, (ii) postoperative pain, (iii) limitation of respiratory movement and (iv) abdominal distension.

On each of these counts the new wide exposure compares unfavourably with the old "blind" operation through a small incision. This latter operation, however, presents so many obvious disabilities that it is rapidly falling into desuetude.

The operation which I have devised and practised now for several years, aims at a combination of the good points of both and the bad points of neither. It allows a complete visual exposure through a thirty-two to thirty-eight millimetre (one and a quarter to one and a half inch) incision and is available for both one and two stage operations.

During the thirteen years ending December 13, 1926, the operation described has been performed, with some important variations, four hundred and thirty-three times with sixteen deaths within one month after operation, a mortality rate of approximately 3.6%. In the last four years and ten months of this period there were two hundred and forty-five operations and seven deaths, a mortality rate of approximately 2.8%. There has been also during this period a very marked corresponding improvement in both immediate and remote results.

From experience it may be definitely stated that equally as good exposure of the prostatic environs is obtainable through the small incision described as through a larger and any procedure indicated in this area is, with the technique described, equally as readily carried out. If during the course of the operation conditions arise which demand a wider exposure, it is a simple matter to enlarge the incision to any desired extent. In my experience, however, this is rarely necessary.

#### Operative Technique.

Suprapubic prostatectomy under intrapharyngeal or intratracheal ether anaesthesia was carried out in practically all the cases of this series. The so-called intraurethral method of enucleation of the prostate, which leaves the *verumontanum* and ejaculatory ducts intact, was the procedure of election.

The bladder is washed out and emptied as completely as possible and the catheter removed immediately before the patient is brought to the operating theatre.

The patient is placed in a low Trendelenburg position and a transverse suprapubic incision made through the skin and fat, varying with the obesity of the patient from thirty-two to thirty-eight milli-

metres (one and a quarter to one and a half inches) in length. The aponeurosis is slit vertically in the mid-line for a similar distance. The recti muscles are separated and the bladder picked up with tissue forceps. The peritoneal reflection is pushed up to the topmost point of the bladder, successive pairs of forceps being applied to the bladder wall until this point is reached, when only the highest pair remains. The bladder is now drawn well up into the incision and acts as an effective plug should, perchance any residuum of lotion or urine escape during the next step.

The bladder is incised between the forceps by careful layer dissection until the mucous membrane is reached. This is picked up with dissecting forceps and nicked to an extent sufficient only to allow the immediate insertion of the nozzle of an electric suction tube (see Figure I). When the bladder is completely empty, the "sucker" is removed and the incision lengthened to admit two fingers. There has been no soiling of the wound by urine or lotion.

Careful digital exploration and visual inspection of the bladder are next made and calculi, if present, are removed.

Bimanual enucleation and removal of the prostate are then proceeded with.

With proper arrangement of sheets and towels and the use of three gloves on the left hand, which are successively removed by an assistant when soiled, no contamination of the operative field takes place, even after manipulation entailing removal and reinsertion of the first and second fingers of the left hand into the rectum.

The electrically lighted bladder retractors which I have had constructed, are now placed in position. These consist of a set of six, four of which are generally used in any given case. They vary in size, shape and length. The longer blades are necessary when dealing with obese patients with deep pelvis. All have the Thompson Walker type of handle and are electrically adapted and interchangeable. These permit a thorough inspection of the bladder neck. This is carefully reviewed and any necessary trimming performed (see Figure II).

After bleeding has received any requisite attention (*vide infra*), the single extended figure-of-eight suture of No. 3 plain catgut is placed, as shown in Figure III, embracing in order the cut edges of the bladder, the fibrous and muscular coats of the bladder and finally the recti muscles and aponeurosis.

The special glass bladder drainage tube is then inserted and the suture drawn tight and tied (see Figure IV).

The operation is now complete, the tube snugly filling the abdominal wound (see Figures IV and V). Occasionally a Michel clip may be placed with advantage in the skin on one side of the flange of the drainage tube.

The dressings are applied and the glass drainage tube fixed firmly in position by zinc oxide strapping placed outside the dressings in such a way that the glass connecting tube may, if necessary for the removal of clots, be disconnected from the rubber

piece on the top of the bladder drainage tube without disturbing the dressings.

#### Control of Hæmorrhage.

When special measures for operative control of hæmorrhage were necessary, which was exceptional, bi-manual compression sufficed in the large majority. In some cases suture of the bladder neck was practised; in others the prostatic cavity was packed with seven and a half centimetre (three inch) sterile gauze which was removed in one to three days depending on the attendant discomfort.

It is of extreme importance both for immediate hæmostasis and to insure satisfactory after results that a complete clearance be made of the prostatic cavity and bladder neck and that the roof, that is to say the region of the vesical sphincter or trigone, should be enabled to fall in on the prostatic cavity without tension. Thus, where a small, tight sphincter or a considerable remnant of slack in the trigonal region remains after the removal of the prostate, it is deeply divided backwards in the mid-line, one stitch being placed by a special needle which I have had constructed, in each side of the incision, as shown in Figure VI, to prevent reunion of the cut edges. Where a thick, fleshy trigonal shelf is present, a wide wedge is cut out and the edges sutured. Furthermore, unless these precautions are adopted, "collar" or "ledge" formation is liable to occur and to lead to persistence of obstruction or its recurrence at a later date.

In the light of our present knowledge no operation can be considered complete unless visualization of the operative field has been practised and any necessary trimming performed followed by careful suture of the bladder neck.

The omission in the "blind" operation of these precautions and the impossibility of their observance is definitely associated with increased liability to hæmorrhage, both immediate and remote, to sepsis and to delayed closure of fistulæ. These, indeed, constitute in the main the *raison d'être* of the new operation.

Instruments of a particular type are essential for the accurate and facile performance of this work through the restricted incision described (see Figures II and VI). Most of these I have had specially constructed.

#### Conclusions.

The methods described admit of a complete, clean-cut, visualized operation and present, I venture to think, several novel features, the details of which have been planned to enable a maximal exposure with a minimal amount of trauma. Postoperative discomfort is thus very largely obviated and wound healing expedited.

The operation while doubtless presenting greater technical difficulties than those usually performed and requiring an armamentarium of and a certain familiarity with instruments of a special type, will, I believe, by its decreased mortality and morbidity rates, well repay the meticulous care demanded in its performance.

MR. J. T. TAIT (Melbourne) wished to express appreciation of Dr. Harris's most interesting illustration of his operation and to congratulate him upon his results. There were still cases of prostatic obstruction which caused much anxiety and those that could with safety be operated upon in one stage, could be separated from those requiring a two-stage method.

With careful pre-operative treatment an increasing number of patients could be placed in the first category. Among eighty patients in consecutive order at St. Peters Hospital, London, sixty-five (82%) were operated upon in one stage and fifteen (18%) in two stages. The disadvantages of removing the prostate after the bladder had been drained for some time, were difficulty in getting free exposure and tendency to the occurrence of omental hernia, even if complete resection of the scar was carried out at the time of the second operation.

The method of most value in pre-operative treatment was continuous drainage of the bladder by means of a tied-in catheter. It was used for all patients with complete retention or a residual urine of more than three hundred cubic centimetres (ten ounces). The catheter was usually kept in position for seven to ten days before operation and through it gradual decompression of the bladder could be easily regulated.

The renal function improved as shown both clinically and by chemical tests. The urea concentration test was used in conjunction with the estimation of the blood urea. A gum-elastic *bicondè* catheter was used for all prostatic patients. It was simply fixed and caused the patient little trouble save a mild urethritis. To be efficient it must be carefully watched and adjusted by the surgeon or a specially trained nurse.

There were still too few early cases, owing to the significance of the symptoms not being realized by patients or their medical advisers. The most important fact in deciding upon operation was the presence of the residual urine. A persistent residual of sixty to one hundred and twenty cubic centimetres (two to four ounces) should indicate an operation. Delay caused a long period of anxiety for the patient and increased the gravity of any operative procedure.

Many patients were in fair clinical condition, though the results of the function tests might be very unsatisfactory. The indications for preliminary cystotomy which could be done under local anaesthesia, were severe infection and when advanced chronic disease of the kidneys was present. The latter were the dangerous cases and drainage might be necessary for a very long time. The cardio-vascular condition was bad and the patients suffered from severe dyspepsia. Two patients had been drained for twelve months and another one died after a prostatectomy which had been done nine months after the preliminary cystotomy.

He confessed that he favoured the large incision. The whole hand could be introduced through the abdominal wall; this gave more control over the manipulation in the prostatic cavity and enabled the surgeon to avoid the use of a finger in the rectum.

A small and adherent prostate demanded a wide opening of the bladder so that the prostate might be removed by open dissection. The method employed was partial enucleation by the finger and completion of the prostatectomy by scissors and forceps.

Operative shock was caused by dragging and tearing and was reduced by working through a large incision.

In the case of a very large prostate it was difficult to remove the prostate from the bladder through an incision 2.8 to 3.2 centimetres ( $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches). The risk of sepsis in the wound and of hernia was very slight with careful closing of the wound. Among sixty-five patients for whom a one-stage operation had been performed, there had been three deaths which was equivalent to 4.6%. These patients did not die from uræmia, sepsis or hæmorrhage, but from factors incidental to a major operation in

patients of advanced age. The mental attitude of the patient was important. Many went to operation convinced that they would not recover.

In the cases in the second group in which the two-stage method was necessary, death had occurred mainly from suppurative pyelo-nephritis. These patients had come to hospital too late and no method of treatment would have saved them.

MR. GORDON CRAIG (Sydney) said that while he admitted the advantages of a large vertical incision, he had found that it delayed convalescence and increased the liability to suprapubic extravascular sepsis. For these reasons he had abandoned it and had evolved practically the same technique as Dr. H. Harris, namely a transverse skin incision with a vertical incision of the muscles. A glass drainage tube was used. The most important step of the operation was the toilet of the vesical neck. Hemorrhage from the prostatic space was a real danger. He controlled it when necessary by means of ligation of the bleeding points applied by means of a curved needle and suitable needle holder. The space was packed with a strip of plain unmedicated gauze. In the majority of cases this gauze packing was unnecessary. When used it should be removed at the end of twenty-four hours. In one case in which the gauze had not been removed early, death followed on the fourth day from pulmonary embolism with the gauze still in position. Thrombo-phlebitis of the prostatic plexus of veins had in his opinion been induced by the prolonged packing with gauze.

A late complication of cicatricial contraction of the vesical neck was a very real danger unless the removal of all redundant tags of mucous membrane was carried out in the toilet of the vesical neck. Some of these cases could be dealt with by dilatation with suitable bougies passed through a cysto-urethroscope.

Sepsis after operation was not controlled by suction, but by washing out the bladder by Janet's method by means of a hundred cubic centimetre syringe fitted with a suitable nozzle to fit the urinary meatus. The solution used was 1 in 3,000 "Merocyl," a synthetic mercurial antiseptic invented at the urological department of the Johns Hopkins Hospital. Weak boric acid lotion or permanganate of potash solution (1 in 5,000) was also useful.

The factors governing mortality were not all in the technique of the operation. For the past five years a careful investigation by cystoscope of the prostatic enlargement was carried out as a routine in all cases. The cystoscopic appearance of the intravesical enlargement governed the type of operation. If the obstruction proved to be of the prostatic bar type, then it was removed by a Young's punch. The hemorrhage was controlled in this operation by a diathermic electrode applied to the bleeding point through a cysto-urethroscope. Renal function was also tested and measures were taken to improve it by an indwelling catheter in some cases that did not respond to this method. Suprapubic drainage was established, followed by a secondary operation at a later date. After treatment was also an important factor in mortality. If asked to express the importance of the various steps in treatment in percentages, he would say that preoperative treatment and investigation would be 75%, the operation 15% and after treatment 10%.

DR. J. A. JENKINS (Dunedin) felt that the ground had been so well covered there was not much left to say, but the question of anaesthesia had not been discussed and it was a very important one, as an ill chosen anaesthetic was one of the chief causes of mortality and morbidity. Spinal anaesthesia was one of the methods of election and he had found that low spinal together with abdominal field block was most useful. He did not like gas and oxygen. He thought that the suprapubic approach gave the operator better control over difficulties. The important features of the operation were a wide exposure through a vertical subumbilical incision, free stripping up of the peritoneum from the bladder, thorough treatment of all raw surfaces with bismuth-iodoform-paraffin paste, free exposure of the interior of the bladder by self-retaining retractors, a circular incision surrounding the internal meatus. This was

deepened until a plane of cleavage was met internal to a rather dense fibrous capsule. Enucleation of the prostate should be carried out with finger or blunt dissection, the gland being drawn up with traction forceps. The overhanging flap of mucous membrane and capsule should be punched out. All bleeding vessels should be controlled, the cavity should be treated with bismuth paraffin paste, the cavity should be packed with gauze around a rubber catheter left in the urethra and the gauze brought out through the suprapubic opening. Lastly the bladder should be closed except for a drain the size of the little finger. The application of bismuth-iodoform-paraffin paste to the prostatic cavity lessened sloughing, sepsis and epididymitis. The gauze and the catheter were removed within the first thirty-six hours and suprapubic suction with the Geissler water pump was carried out for three to five days. From the fifth day a special suction cut was applied, which Dr. Jenkins demonstrated. When the prostate was fibrous and could not be enucleated, the gland could be punched away with a Hartmann's cochotome. He mentioned a few points in connexion with complications. Reactionary hemorrhage was one of the chief causes of death. A small hemorrhage within a few hours of operation had an effect out of all proportion to the quantity of blood lost. Retention of clot in the bladder had an intensely depressing effect and attempts to remove it a more evil one. Pulmonary complications could be treated only by careful nursing. The method of anaesthesia was important. Attention to adequate support of the testis helped to prevent epididymitis. Ligation of the base seemed to be the only certain way of preventing this. Pyelo-nephritis was lessened by forced fluids and alkalis. Uraemia was probably one of the least understood of all renal conditions. It could be induced by several separate factors. No one test or group of tests done before operation could exclude its onset after operation. Renal function tests did not always indicate its near presence. Dr. Jenkins quoted an interesting case in which the renal function according to the phenolphthalein and total non-protein nitrogen tests appeared to be normal, but the uraemic symptoms appeared the morning after operation. The patient had been transfused with a litre of blood and half a litre of 10% glucose solution. After this he had become conscious in an hour. The factor which appeared to have precipitated the coma, was a sudden fall of blood pressure. He believed that in acute or chronic cases of retention of urine it was better to employ suprapubic drainage under local anaesthesia if the ordinary methods of treatment failed. The important thing in decompressing a distended bladder was to remove a small quantity. A large number of patients were admitted to hospital too late, many patients were killed by unskilled attempts at catheterization.

DR. B. KILVINGTON (Melbourne) said there were two types of fibrous adherent prostate, one the fibroadenoma and the other the sclerous carcinoma. He never attempted to remove this digitally, but used a special punch. A good exposure was necessary. He cut a funnel-shaped passage through the prostate, while his assistant kept his finger in the rectum to guard the progress of the punch. These patients passed urine quite well. There was not much bleeding. There were no frayed pieces of tissue to necrose and become infected. The pieces were examined microscopically and if malignant changes were found, radium was applied and later X ray treatment was given to shut off the lymphatics. Urinary obstruction was relieved and life prolonged thereby.

MR. H. B. DEVINE (Melbourne) wished to ask Dr. Harris if he attached any importance to early closure of the fistula with relation to thrombosis. He liked to keep the bladder open for two weeks or so. He had used suction for twelve years. It was a most important part of the postoperative treatment. The large quantity of air passing through the bladder kept the wound clean. He fixed the suction tube just down to but not into the bladder.

SIR GEORGE SYME (Melbourne) had performed prostatectomy for the first time thirty years previously. He congratulated Dr. Harris on the demonstration of his methods. There had been no mention of perineal prostatectomy for the hard fibrous prostate. He supposed it was due to the introduction of punches. When there was



a possibility of malignant disease, a better exposure could be obtained through the perineum and was preferable. There were risks, such as damage to the rectum. He had experienced recurrent hæmorrhage after leaving the bladder perfectly dry at the end of the operation; he always found it safer to plug the cavity. The use of a sucker improved the after treatment. Except for the first twenty-four hours while the tube was in position, he used the sucker in the wound. Functional tests were useful, but not absolute and they should be prepared for any emergency. Nobody had mentioned cystoscopy before operation; what was the value of this?

DR. S. HARRY HARRIS in his reply stated in answer to Mr. Tait that if sufficient time were left after a preliminary cystotomy, the technique which he described was applicable also to a two stage procedure, but instead of the transverse incision a vertical incision 2.5 centimetres (one inch) in length was employed downwards from the cystotomy opening. With reference to the delivery of a large prostate through a small incision this must be effected like a fetus in its long axis, the anterior commissure of the prostate if necessary being broken through. Dr. Harris was interested to hear that Mr. Gordon Craig had abandoned the large vertical incision and had become a convert to the glass bladder drainage tube which he, Dr. Harris, had been using for so many years. There was no question of the fact that the toilet of the bladder neck was an essential part of the operation and in the light of their present knowledge, no operation could be considered complete when adequate trimming and suture of this region had not been carried out.

In answer to Mr. H. B. Devine, Dr. Harris stated that he thought the earlier the fistula closed, the better for the patient. He thought that the complete closure of the bladder after operation, if this were possible, would be the ideal operation and he hoped that they were in measurable distance of this.

### SECTION III.—OBSTETRICS AND GYNÆCOLOGY.

#### THE INDICATIONS FOR AND THE MANAGEMENT OF THE TRIAL LABOUR.

By J. C. WINDEYER, M.D., Ch.M. (Sydney),  
Professor of Obstetrics, The University  
of Sydney.

ALECK W. BOURNE in his book, "Recent Advances in Obstetrics and Gynæcology," gives the following definition of "trial labour": A term used to denote a labour which is being closely watched with a view to terminating it by Cæsarean section should the head not show signs of engagement and descent.

This definition emphasizes several points.

Firstly, the medical attendant has by antenatal examination recognized that there may be difficulty in delivery.

Secondly, after full examination there is still some doubt whether the child can be delivered *per vias naturales* or whether a Cæsarean section will be necessary.

Thirdly, it indicates also that the head should be the presenting part.

Fourthly, the medical attendant is conducting the case in such a way that the delay in performing the operation causes little if any further risk to the mother.

Finally, it indicates that forceps application to the disengaged and non-descended head is not to be considered as a possible method of delivery.

I wish to enlarge upon these five points in my address to you today and I shall consider them in detail later on. Here I would ask you to permit me to diverge a little from my theme and to ask why we do not perform Cæsarean section in all cases of possible difficulty in delivery. The answer is firstly that in the majority of such cases Nature is able to overcome the difficulty and a natural or slightly assisted delivery occurs.

Secondly, Cæsarean section, although it is a comparatively easy way out of a temporary difficulty and is certainly advantageous as far as the child is concerned, carries a fairly heavy risk to the mother in several ways. Three of these may be considered. The first is the immediate risk. Statistics on Cæsarean section show 1% or 2% mortality in clean cases and a very much higher one when vaginal examinations or attempts at delivery have been made.

The second risk is that of rupture of the uterine scar in future pregnancies or labours. This risk is difficult to estimate, but Eardley Holland's<sup>(1)</sup> figures prove that there is at least a 4% risk of this accident.

The third risk is sterility. Figures from Eardley Holland's report indicate that pregnancy occurs in only 44% of patients who have undergone Cæsarean section. In some of the 56% of cases of sterility contraceptive methods undoubtedly play a part, but the absolute sterility rate must be a high one. J. Webster Bride<sup>(2)</sup> has estimated that 34.7% of patients on whom Cæsarean section has been performed, are sterile.

When one further considers the five points that I have mentioned above, one notices that the first two points are concerned with the indications for a trial labour and the last three are concerned more with the management of it after the decision has been made.

#### Conditions Necessitating a Trial Labour.

What are the conditions that may necessitate a trial labour and how does one recognize their presence?

In their order of frequency one finds that contracted pelvis is by far the commonest cause, then follows oversize of the fetus; tumours or cicatrices of the soft parts are uncommon causes of trial labour and I shall not consider them further.

Contracted pelvis may be suspected from the history of a *multipara*. The more advanced degrees of pelvic contraction are often accompanied by other skeletal deformity or diminution in stature, but the minor degrees of contraction are sometimes present in women whose development is apparently normal. We can detect these abnormalities by means of pelvimetry.

I am strongly of the opinion that pelvimetry should be performed early in pregnancy in all *primiparae* and in any *multipara* whose obstetric history is not a good one. If one waits till the thirty-seventh week before performing pelvimetry as advised in some textbooks, one may not only miss the most opportune time for an induction of

labour, but one may put the patient to the unnecessary expense of preparing for the confinement at home and then find that her pelvis is of such dimensions that treatment in hospital is essential for the proper and safe conduct of her labour.

One should at this early examination estimate not only the interspinous, the intercrystal and the external conjugate diameters, but also the diagonal conjugate of the brim of the pelvis and the transverse diameter of the outlet.

If the transverse diameter of the outlet is diminished, one should measure the posterior sagittal diameter as well. In some women it is difficult to estimate properly the internal diameters and in these cases one should perform pelvimetry under an anæsthetic with a pelvimeter such as that of Skutsch, as with this instrument one can measure the various diameters much more accurately than by any other means. After having measured the pelvis in the early months, one is in a position to give an opinion as to the method of termination of the pregnancy.

If there is an advanced degree of pelvic contraction, Cæsarean section is indicated; in the more moderate degrees of contraction where vaginal delivery is possible, the trial labour has to be taken into consideration.

One should decide later on in pregnancy when one estimates the relative size of the foetal head and the pelvic brim.

What are the degrees of pelvic contraction that may necessitate a trial labour?

One cannot give a definite answer to this question, as in the great majority of cases the size of the passenger has to be taken into consideration.

In *multiparæ* the history of previous confinements is also of great importance, as one finds that one woman with a certain degree of pelvic contraction will have easy labours and another with a similar decrease in measurements will always have difficulty in delivery; the heads of the children in one mould readily and the uterus acts strongly, whereas the reverse conditions occur in the other.

Roughly one may state that as regards contraction of the conjugate diameter of the brim a diminution below 8.75 centimetres (three and a half inches) contraindicates a trial labour, as one has to induce labour so early that the foetus has but a small chance of survival. Induction before the thirty-sixth week gives bad foetal results, but from the thirty-sixth week to term the results are good.

I consider that induction of labour from this period onwards is a good method of treatment.

When disproportion is present before full term, one is sometimes in doubt as to the possibility of the passage of the head through the brim. Under such circumstances I think we should rely more upon the medical than upon the mechanical methods of induction as the medical methods carry no risk of infection and if descent and engagement do not occur, one can perform Cæsarean section with but little extra risk.

As regards contraction of the outlet of the pelvis one is placed at a disadvantage in that one cannot

test the relative size of the foetal head and the pelvic outlet as one can in the case of the brim of the pelvis.

In contraction of the outlet I have found Whitridge Williams's<sup>(3)</sup> figures of value in deciding between Cæsarean section and vaginal delivery, but in outlet contraction it is more a question of deciding between a Cæsarean section before or at the commencement of labour and a spontaneous or operative delivery by the vagina rather than upon a trial labour to be followed by Cæsarean section, if it fails.

How does one detect oversize of the foetus?

There are various methods by which one can form an estimate of the size of the foetus. Whilst none of them are accurate, with care one can form an opinion as to whether the foetus is under, about or over the normal size. Inspection, palpation, mensuration should always be used and at times X ray examination is of service.

If one makes a habit of estimating the size of the foetus whenever one examines the abdomen of a pregnant woman, one finds that one can predict the weight fairly accurately in a large proportion of cases.

The following are some of the findings in a case with an oversized or post-mature foetus. On inspection the uterus looks larger than usual. Mensuration shows that the uterus is increased more in length than in width. The highest part of the foetus is found to be more than 27.5 centimetres (eleven inches) above the top of the *symphysis* when measured with callipers. On palpation the resistance of the foetus is felt by the examining fingers to be close up to the uterine wall, the contents of the uterus feel solid. This is especially the case when the back of the foetus is anterior, the broad continuous convex resistance of the back is then an outstanding feature.

One should always look for an oversized foetus in later examinations during pregnancy, as the oversized and especially the post-mature foetus may cause great difficulty in delivery.

#### Relationship of the Head to the Brim of the Pelvis.

What are the methods by which one can make an estimate as to whether the head will or will not pass through the brim of the pelvis?

There are three methods in which one uses the foetal head as a pelvimeter. One is the combined abdominal and vaginal manipulation commonly known as Munro Kerr's modification of Müller's method. The others are wholly abdominal methods and as they are without risk to the patient, I prefer to use them. If the head has settled down slightly into the plane of the brim, one can easily estimate any disproportion as follows: The two hands are placed over the lower part of the patient's abdomen, one on either side of the middle line, the tips of the fingers directed towards her feet; the fingers palpate the top and front of the pubic bones and the *symphysis* and thus estimate the thickness of the bones.

The hands are then pressed backwards until the palmar surface of the fingers meet with the resistance of the foetal head. The fingers are kept extended and they then slide downwards and backwards parallel to the axis of the brim of the pelvis.

The finger tips may slide down into the brim of the pelvis or they may impinge on the top of the *symphysis* or in advanced degrees of overlapping they may slide down over the front of the pubic bones on one or both sides.<sup>(4)</sup>

The second abdominal method is but a modification of the first and should be used when the head is higher and floating above the plane of the brim. Under such conditions after palpation of the pubic bones, the head is pushed down towards the brim and steadied there by the left hand, whilst the right hand slides down over the resistance of the head and estimates the degree of overlapping of the brim.

In my experience if the most forwardly projecting portion of the foetal head, as estimated by the examining fingers, is felt to overlap half the thickness of one or other pubic bone, the head will mould and enter the brim of the pelvis. But if the overlap is greater and especially if the head covers the whole thickness of the pubic bone, engagement will not occur and a Cæsarean section is indicated.

With an oversized, post-mature foetus, as the head is firm and unyielding, an overlap of half-way across the *symphysis* will probably indicate a Cæsarean section.

#### Position of the Foetus.

Once one has decided upon a trial labour it is essential that the passenger should attempt to enter the passage in the most favourable way.

By this I mean that abnormal presentations and positions should be rectified before labour begins.

A breech or shoulder presentation should be changed to a vertex by external version and an abdominal support applied. With the vertex presenting one can estimate the relative size of the foetal head and the pelvic brim and thus be in a position to state whether there is a chance of the head going through the brim or whether the disproportion is too great for a delivery *per vias naturales*.

An occipito-posterior position should be rectified by Buist's method.

In minor degrees of contraction of the brim, the head may not enter the brim when the occiput is posterior, but it will do so quite readily when the occiput is rotated to the front. Similarly, the head of a foetus above the normal in size may have difficulty in entering the brim of a normal pelvis when the occiput is posterior, but the difficulty disappears if the occiput rotates to the front. In both these types there is disproportion with an overlapping of the brim when the occiput is posterior and this overlapping disappears very much more often than not when the abnormal position is rectified.

Of course, in flat pelvis the head may go through the brim more easily when the occiput points directly to one or other side of the pelvis, the so-called occipito-transverse position which is frequently

seen in normal cases before engagement of the head takes place. It is a pity that English textbooks do not include the transverse positions of the occiput in their nomenclature.

The overlapping in occipito-posterior cases which I have termed apparent overlapping is quite a common condition and in any case of disproportion an occipito-posterior position should be excluded before an estimate of the degree of disproportion is made.

#### Avoidance of Risk to the Mother.

Once one has the passenger in the most advantageous position for its entrance into the pelvis, one can await the onset of labour or, if the indications for an early labour are present, one may induce labour by the usual medical means, repeating them if necessary. Some authorities are willing to admit the mechanical methods of induction in these cases, but I feel that they carry an unnecessarily grave risk to the mother and do not advise them. The figures given by Professor Munro Kerr and Mr. Eardley Holland show that there is a 14% mortality following induction by mechanical means.

It is probable, however, that there are many amongst the 14% of deaths in which there had been much more vaginal interference than is necessary in a simple bougie induction of premature labour.

During a trial labour when every vaginal examination adds to the risk of the possible subsequent Cæsarean section, we should note the progress of the case by other means and in this regard I would particularly emphasize the importance of the



FIGURE I.

Illustrating successive markings of the anterior shoulder in a trial labour. The head was not engaged and overlapped half the thickness of the *symphysis* at the commencement of labour; the upper black spot indicates the position of the shoulder; at this stage it was ten centimetres (four inches) above the *symphysis* (indicated by black line); the two lower spots indicate the descent of the shoulder during labour.



abdominal methods of examination. They can be employed as often as one wishes without any risk to the patient. One can estimate the amount of the descent of the head into the pelvis by means of the anterior shoulder which is usually easy to locate and if one marks its level at the onset of labour and at subsequent examinations, one can detect any advance (see Figure I).

Further by estimating the relative size of the foetal head and the pelvic brim by the external methods as described above, one can detect a decrease in the degree of disproportion which will indicate that moulding of the head is taking place. One can also note the levels of the occipito-nuchal junction and the chin to detect flexion and descent.

If one wishes to determine the degree of dilatation of the cervix or to verify the amount of descent into the pelvis, this can be done without risk by rectal examination.

When the second stage of labour commences, the patient should be made to assume Walcher's position in order to increase the conjugate diameter of the brim and thus facilitate descent and engagement of the head.

#### Forceps Application and General Management.

Should one in a trial labour attempt delivery by means of the forceps before resorting to Cæsarean section?

There is no doubt that failure of an attempt to deliver the patient by forceps adds very greatly to the risk of a subsequent Cæsarean section and one must be very sure of the probability of success before taking this grave extra risk. The head should have descended at least partly through the brim and the anterior shoulder should be not more than 7.5 centimetres (three inches) above the brim; also practically all of the overlapping as felt from the abdomen should have disappeared.

When the head has not descended at all into the brim as indicated by non-fixation, by persistence

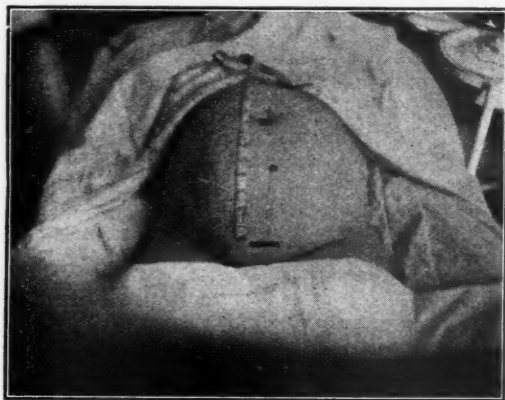


FIGURE II.

Illustrating non-descent of the shoulder in a trial labour. The shoulder (marked by black spot) remained eleven and a quarter centimetres (four and a half inches) above the symphysis; the overlapping of the brim persisted and therefore Cæsarean section was performed.

of the anterior shoulder at a level of 10 or 12.5 centimetres (four or five inches) above the top of the symphysis (see Figure II.) and by the persistence of the overlapping, then high forceps application is definitely contraindicated and a Cæsarean section should be performed.

For what length of time should one persist with a trial labour before resorting to a Cæsarean section?

In quite a number of cases with slight disproportion descent occurs shortly after labour sets in, in others descent occurs later and when moulding is delayed or the pains are not strong, descent may not occur until several hours after the second stage has begun.

For many years I have advised eight or ten hours trial labour without vaginal examination before doing a Cæsarean section in *primiparae* and I cannot say that I have seen any bad results from this method of treatment.

It is advantageous in that one has a certain amount of dilatation of the cervix to permit easier exit for the lochial discharges and clots when it is necessary to perform Cæsarean section.

But cannot we permit a trial into the second stage of labour in order to obtain the direct driving action of the uterus on the body of the child, which will have more effect in moulding and forcing the head through the brim?

Quite a number of authorities are advising this course of treatment and if the trial fails, they recommend the low or cervical Cæsarean section.

It seems to me that a woman can be permitted to undergo a full trial labour with from two to four hours in the second stage, observations of the progress being made mainly by the abdominal and partly by the rectal methods of examination with good results.

It also is apparent that the low cervical Cæsarean section is the best method of terminating those cases in which the trial labour has failed to produce engagement and descent of the head. The transperitoneal method of approach to the lower part of the uterus appeals to me more than the extra-peritoneal method.

#### Conclusion.

With a complete antenatal examination it is possible to differentiate between those cases in which a Cæsarean section is definitely indicated and those in which a trial labour is advisable.

The full trial labour will terminate in a delivery *per vias naturales* in the great majority of cases and in those in which it fails, the risks to the mother will not be appreciably greater if the trial labour is properly conducted. If the medical attendant has any doubts in his mind as to his competence to decide upon some of the more difficult questions that may crop up in cases of disproportion, he should seek the advice of or transfer the patient to a more competent obstetrician.



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## THE OPERATION OF PUBIOTOMY.

By A. BONAR LINDSAY, M.R.C.S., L.R.C.P.,  
Christchurch.

I MUST first express thanks for the honour of making a contribution to this discussion. I propose to deal with the operation of pubiotomy, to record a small series of cases in which pubiotomy has been done and to discuss what place, if any, the operation occupies in obstetrical practice.

The modern operation dates from 1893 when Gigli conceived the idea of a lateral incision through the pubic bone. He operated on his first patient in 1902.

In 1904, Döderlein introduced the half-open subcutaneous method which is now the operation of choice. It is described in all text books, so it is unnecessary to consider the details here.

The operation at first enjoyed a considerable vogue, but of late years has fallen into partial disuse. De Lee wrote that the operation is obsolete, a statement difficult to justify. A. H. Bill, of Cleveland, discusses in a recent journal: "Should pubiotomy be recognized as a justifiable operation in obstetrics?" and assigns it a limited field.

Again, there is among those who advocate the operation, a difference of opinion as to the most suitable time for operation. Jellett advises it as a prophylactic operation as well as an emergency measure. Williams and Bill regard it as an emergency measure only. The last-named also advises the use of a prophylactic saw, that is a saw placed round the pubic bone, in certain cases associated with contracted pelvis. Fitzgibbon does not agree with this. He says he would never allow labour to go on with the definite decision to perform pubiotomy. In doubtful cases he would perform section. Where the leaders of the profession are divided in their opinions, it would be presumptuous on my part to do more than suggest the lines of profitable discussion.

Pubiotomy is an operation suitable for a condition in which there is disproportion between the size of the head and the pelvis. The greater number of such cases are due to contracted pelvis, hence we may practically consider it in relation to contracted pelvis alone.

There are forms of contracted pelvis for which Cæsarean section is necessary, because pubiotomy does not cause sufficient enlargement of the pelvic

diameters. On the other hand there are many cases in which natural delivery is difficult, dangerous or impossible. In these pubiotomy offers a very valuable alternative. These cases can be divided into two groups.

In the first group, pubiotomy is indicated as an emergency measure because the disproportion is too great to be overcome by the natural forces or by forceps. The patient is advanced in labour and considerable vaginal manipulations have occurred. If pubiotomy is to be considered there must be: (i) a live baby, (ii) an antero-posterior diameter of not less than seven centimetres.

It is obvious that with more perfect antenatal care and diagnosis, this group will practically cease to exist, but since in actual practice such cases occur, one must consider what procedures are available for effective delivery.

These are three: (i) Low Cæsarean section, (ii) craniotomy, (iii) pubiotomy. Even with the low Cæsarean operation the mortality from shock and infection must be considerable. Polate says he does not believe the low Cæsarean section is a panacea against infection. Whitridge Williams advises a radical section in all cases where infection seems certain. The mortality rate of Cæsarean section done late in labour is always very high. A destructive operation on a live child is generally held not to be permissible. We must therefore, turn to the third method.

Pubiotomy is in these cases an emergency measure. It is an alternative to craniotomy rather than to Cæsarean section, because the time suitable for the latter operation has passed.

In the second group of cases, the presence of a contracted pelvis has been recognized during pregnancy. In the case of a *primipara* the contraction will have been recognized in the routine estimation of the size of the pelvis. In a *multipara* the obstetrical history furnishes an additional guide.

The available methods of treatment are: (i) Induction of premature labour, (ii) Cæsarean section, (iii) pubiotomy. The objections to induction are its high fetal mortality; (Banister gives a corrected figure of 12½%); the necessity for repetition with each subsequent pregnancy; maternal sepsis.

The objections to Cæsarean section are: the necessity for repetition with each subsequent pregnancy; the increased tendency to peritoneal adhesions and complications with each operation.

I may now conveniently discuss the advantages and disadvantages of pubiotomy.

## Advantages.

The outstanding advantage of pubiotomy is that it is a method of treatment which does not necessarily require repetition. Sandston showed that it causes an enlargement of the pelvic diameters due not only to the lateral displacement of the pubic bones, but also to the outward and downward movement. A similar movement occurs in the Walcher position. Jellett pointed out that this enlargement could be made permanent and so a permanent cure resulted in suitable cases.

The operation itself is a simple procedure and can be leisurely performed in fifteen minutes. It is difficult to understand Eden's statement that pubiotomy is a more formidable procedure than Cæsarean section.

The maternal mortality is low. Döderlein in 1910 gave it as 1·8% among 321 patients. Whitridge Williams in his 1924 edition says his experience indicates it should not be greater than that figure. Higher rates were frequent in the earlier records of this as of other operations. It is obvious that pubiotomy *per se* must carry a very small mortality. The mortality of the prophylactic operation is very considerably smaller than that of the emergency operation.

The foetal mortality rate is given by Williams as 12%, Jellett gives less than 8% in 195 collected cases. Here again the rate should vary according to whether the operation is done in Group 1 or Group 2.

#### Disadvantages.

Hæmorrhage may occur during the operation. It is usually profuse as the saw completes the division of the bone. It can be easily controlled by packing. A hæmatoma of the labium is not uncommon.

A vaginal tear may open up a path of infection to the sawn edges of the bone. Infection of the venous plexuses may lead to femoral thrombosis. This vaginal tearing is particularly liable to happen in *primigravida*. It is most prone to occur when delivery follows at once after the operation.

It has been alleged that interference with walking occurs. Whitridge Williams says that when the separation does not exceed four or five centimetres, his patients were able to walk and work as well as before. I have not met with this complication and Jellett does not record it in his cases.

The decision to perform pubiotomy is only permissible after careful measurement of the internal diameters of the pelvis. Otherwise, it is impossible to give a guarantee of successful delivery. I believe it is for these reasons that it has not been more freely adopted and it is for these reasons that so far I have performed pubiotomy only in the upper limits of the pelvic measurements in which the operation is permissible.

In the earlier part of this paper I suggested that greater antenatal care would reduce the necessity for pubiotomy as an emergency procedure, but the converse is true in the case of the prophylactic operation. Antenatal examination can reveal the presence of a degree of contraction suitable for radical cure and the field for pubiotomy will be thus increased.

Among the recent pronouncements on the use of pubiotomy there is Whitridge Williams's statement in 1926 that he has slowly learned that, while pubiotomy gave satisfactory maternal results, it was associated with a high foetal mortality. He has finally limited its application to funnel pelvis and as an emergency measure only.

At the same time it should be noted that his figures reveal that when his operations for pubio-

tomy decreased, his destructive operations increased. This is shown in the following table:

TABLE I.—PERCENTAGE FREQUENCY OF OPERATIONS FOR CONTRACTED PELVIS (WHITRIDGE WILLIAMS).

Period.	Destructive Operations	Pubiotomy.	Cæsarean Section.
1905-1910	1·67	40·0	18·33
1910-1924	13·12	3·50	64·43

On the other hand, Fitzgibbon in the last four years has performed the operation eighteen times with the delivery of thirteen living infants. His conclusion is that pubiotomy is easy to perform, safe for the mother and saves the child.

In presenting my cases, I do so with the greatest diffidence, because I realize that there is one case at least in which I should have waited a test of labour and there may be other cases in which you will think that delivery with moulding and forceps might have occurred.

I feel, however, that in the whole question of the treatment of contracted pelvis it is not the actual performance of the operative procedure which represents the difficulty, but rather the striving for the correct decision so that delivery may be *non vi sed arte*. These histories are records of such striving.

#### Case Records.

CASE I.—Mrs. A., aged twenty-six years, a farmer's wife, had had two pregnancies and had lost both her babies after very difficult labours. Her height was under 150 centimetres (five feet). When seen she was seven months pregnant. Pelvimetry gave the conjugate as 8·4 centimetres and the transverse as 11·4 centimetres. The transverse of the outlet was eight centimetres.

Pubiotomy was performed on February 26, 1923, and an X ray on March 14, 1923, revealed a separation of slightly less than 12·5 millimetres (half an inch). The patient delivered herself on May 7, 1923, of a child weighing 3,232 grammes (seven pounds, two ounces) after a normal labour of six and three quarter hours.

Seen two years later she suffered from no disability in walking or working on the farm. She has since again delivered herself of a live child without assistance.

CASE II.—Mrs. B., aged twenty-eight years, had had two previous pregnancies. She had lost both babies, the first weighing 2,041 grammes (four and a half pounds), as a result of eclampsia, the second by craniotomy.

Pubiotomy was performed on September 24, 1924. She had a normal labour. Her doctor informs me the baby was "normal in size." Unfortunately I have mislaid the measurements, but the degree of contraction was not marked. The antero-posterior diameter was, I believe, just under nine centimetres.

CASE III.—Mrs. C., aged twenty-three years, *primigravida*, was under observation at St Helen's and was discovered to have a contracted pelvis. Her pelvic measurements were antero-posterior nine centimetres and transverse twelve centimetres.

There was evident disproportion at the thirty-eighth week and I decided to do a pubiotomy. This was performed on May 20, 1925. During the operation I inadvertently touched the pubic wound with the forefinger which had been placed in the vagina for the purpose of directing the Döderlein needle. After the pubiotomy the patient came in labour and delivered herself on May 24, 1925, with ease of a baby weighing 3,062 grammes (six pounds twelve ounces). There was a very slight perineal laceration. Convalescence was marred by a thrombosis which affected the left leg and then the right. Save for a slight serous

discharge, the wound healed without suppuration. I am of opinion that there was a mild infection causing thrombosis in the venous plexuses under the symphysis which spread first to the left and then to the right saphenous vein.

CASE IV.—Mrs. D., aged twenty-seven years, a *primipara*, she lost her first baby. Her doctor tells me that he delivered a small macerated foetus with the greatest difficulty. Unfortunately no ante-natal care was taken in the second pregnancy and I saw her after forty-eight hours of labour, the head in no way entering the brim. The membranes were ruptured. The baby was alive. Internal measurements were antero-posterior 8.8 centimetres, transverse 11.3 centimetres.

Pubiotomy was performed on the evening of December 18, 1925, and the patient returned to bed to await reappearance of labour pains which had ceased. The following morning the os was found to be fully dilated. The head was then pushed down into the pelvis as far as possible and forceps applied. Gentle traction delivered a live baby weighing 3,175 grammes (seven pounds). Vaginal examination revealed two and a half centimetres (one inch) of separation after delivery and a skiagram taken on January 5, 1926, revealed 1.25 centimetres (a half of an inch) of separation.

The patient nine months after delivery suffers from no disability in walking, but occasionally, if she holds her leg in a certain way (not described), feels a weakness. A skiagram now reveals the formation of new bone in the inner part of the obturator fossa, but the pubic bone remains ununited.

CASE V.—Mrs. E., aged twenty-one, lost her first baby after a difficult forceps delivery as described by her doctor. The baby weighed nine pounds.

I examined this patient and found she had a somewhat funnel pelvis. I was not particularly anxious to do the operation on this case as the measurements were antero-posterior 9.5 centimetres, transverse eleven centimetres, transverse at outlet 8.5 centimetres.

However, I decided in favour of the operation and it was performed at the fifth month of pregnancy. Considerable oedema of the labia occurred necessitating catheterisation. A Bradford frame was tried but it was found more comfortable to nurse the patient propped up. At term she delivered herself without assistance of a child weighing eight pounds nine ounces after a labour of five hours.

CASE VI.—Mrs. F., aged twenty-seven years, was delivered of her first baby weighing 3,742 grammes (eight and a quarter pounds) by craniotomy. On examination she was found to have received severe injuries to the pelvic floor and perineum. Her pelvic measurements were antero-posterior 8.5 centimetres, transverse 12.5 centimetres.

Pubiotomy was performed on September 28. The patient was up on the eighth day and walked two hundred yards at the end of the third week. The course of labour suggests, however, that the degree of separation was not great. No skiagram was taken in this case. Labour proceeded with slow dilatation for twenty-six hours. At the end of this time, the os was fairly well open. I ruptured the membranes and allowed the second stage to proceed for two hours. The head descended into the brim and I applied forceps. After the application of a little more traction in the Walcher position than I am in the habit of applying, something was felt to give and the head at once passed the brim. I believe that it was the new bone at the site of the pubiotomy which separated and allowed the bones to separate. New bone is seen in the skiagram. The child was born without injury and cried at once lustily. It weighed 3,629 grammes (eight pounds).

CASE VII.—This case which records an error both in diagnosis and judgement, shows that pubiotomy cannot be expected to take the place of appropriate treatment.

Mrs. G., a St. Helen's patient, who had been pregnant twice before, was recorded as having a flat contracted pelvis. She had not attended the ante-natal clinic and was first seen by me some hours after the membranes had been ruptured, the head being high up at the brim.

Under anaesthetic, I examined her with a hand in the vagina, diagnosed a right occipito-posterior presentation

and swept the foetus round by grasping the right shoulder and rotating. I then left the head to mould. Five hours later the head had somewhat entered the brim. I applied forceps, but was unable to deliver. After three applications of the forceps, I decided to remove her to hospital for operative procedure. The measurement of the antero-posterior diameter of the brim was ten centimetres. I thought the child must be large. It was alive.

I decided to do a pubiotomy. This was done without difficulty in a few minutes. I then applied forceps, but again was unable to extract. After repeated attempts, I judged the child to be dead and perforated. Extraction was more difficult than I have ever experienced and when the child was eventually born, I found I had perforated near the anterior fontanelle.

I think that as I withdrew my hand after rotating the shoulder, I caused the head to extend producing something approaching an anterior fontanelle presentation. I believe the measurements of the case to have been suitable for pubiotomy, but the correct treatment to have been version.

DR. A. M. WILSON (Melbourne) congratulated Dr. Bonar Lindsay on his paper and said that he would certainly try prophylactic pubiotomy on his return. He had once torn the vagina while doing an emergency pubiotomy. In one patient callus had grown internally and obstructed the following labour. This experience had deterred him from trying the operation. With the trial of labour the attempt should not be considered complete unless the membranes had been ruptured for two or three hours. In Melbourne they make one or two vaginal examinations during the labour. In border-line cases the condition of dilatation of the cervix was noted. If it was dilated after the rupture of membranes, labour would proceed; if it was not dilated and if there was extension of the head, Cæsarean section would probably be required. Careful asepsis of the hands was necessary.

DR. J. W. DUNBAR HOOPER (Melbourne) asked for information concerning the suture material employed in Cæsarean section and whether morphine in small doses in trial labour was permitted. He also asked how long after pubiotomy it was necessary for the patient to rest.

DR. C. NORTH (Dunedin) asked if there were any statistics of the rupture of the scar after low cervical Cæsarean section.

DR. HENRY JELLET (Christchurch) said that he had written a paper entitled "The Radical Cure of Pelvic Deformity" which had been published in *Surgery, Gynecology and Obstetrics* (August, 1919). He had advised the operation as a prophylactic one. He wished to emphasize the teaching that pubiotomy was not merely a method of terminating a difficult labour; it was rather a means of effecting a radical cure of pelvic contraction. Pubiotomy was indicated in both the first and second degrees of contracted pelvis. Pubiotomy was not an alternative to Cæsarean section any more than was the wiring of a fractured bone an alternative to amputation of the limb. Pubiotomy should never be postponed willingly to the end of the second stage, but should ideally be carried out independently of pregnancy when its effects were likely to be required. Every effort should be made to prevent bony union of the cut surfaces. He considered that a woman after pubiotomy should have the maximum amount of movement. Bony union was not desired. He concluded by saying that he regarded Professor Windeyer's remarks with veiled hostility.

PROFESSOR WINDEYER stated that in cases of low cervical Cæsarean section de Lee had reported two cases of rupture of the scar in a series of 320 operations. His method of abdominal palpation did away entirely with the necessity for any vaginal examination. If it was necessary during the trial labour to know the condition of the cervix, a rectal examination was all that was necessary. As regards the exhibition of morphine, he recommended small doses. For suture material he used thick, plain cat-



gut. Rupture was due to incorrect coaptation of the edges of the uterine womb. The operation should be very accurate and careful in approximating the edges. He demonstrated his method.

DR. BONAR LINDSAY in reply said that Dr. Jellett had really replied to all questions. He wished to state that one of the disadvantages of pubiotomy was that the patient had to undergo an operation and later had also the delivery to look forward to.

#### UTERINE INERTIA: ITS THEORY, SYMPTOMATOLOGY AND CAUSATION.

By MARY C. DE GARIS, M.D., B.S. (Melbourne),  
Geelong, Victoria.

THAT uterine inertia, not puerperal sepsis, is the central and fundamental problem of obstetrics is sufficiently shown by the fact that it is universally recognized as the commonest cause of delayed labour even in rickety countries; as also by the fact that the maternal death rate rises with the duration of labour. Jardine says it is four times greater in labours lasting over twenty-four hours than in labours lasting under twenty-four hours, while in labours lasting over thirty hours it is twelve times greater. The general advice given to try "the test of labour" in the slighter cases of contracted pelvis shows that a moderately efficient uterus can deal with moderate pelvic contractions, so that the chief need in the control of average labour is to secure efficient uterine action.

A satisfactory study of uterine inertia is far to seek, chiefly because of the absence of a standard of normal uterine action; this we should find in the definition of normal labour. What has passed for such has been merely a generalized description of average labour and one, moreover, which ignored the mother's point of view and the uterine contraction, failing even to mention the most distinctive feature of average labour, its pain and suffering. The curse of Eve has hypnotized the clinician, the physiologist and the woman herself. Custom has staled us to the suffering, has made us think it necessary, while the current religious teaching has made us think it right, though exceptional cases of painless labour have occurred to prove that it is not necessary and to suggest that it is not right. "Cherish our exceptions," as Bateson taught.

That present day labour and child-bearing are pathological is sufficiently attested by the death rate attending maternity and early infancy, as well as by the suffering attached to motherhood. As motherhood is at the source of life, improvement there is truly radical, not merely palliative, and may bear unheard-of fruit.

The theory of obstetrics needs revision. Let us study labour itself, instead of devoting attention merely to end-results, such as serious disease and death rates.

Child-bearing is one clinical entity occurring in successive stages, pregnancy, labour, puerperium and including its result and objective—the infant. Sepsis, toxæmias, hæmorrhages, infantile morbidity

and so forth are complications of child-bearing as a whole and not of its individual stages. We must adopt a medical and physiological outlook on the whole process. Labour is its most active and indicative phenomenon and must receive special attention.

Three things are necessary to healthy motherhood: (i.) A normal labour dependent on knowledge of the factors on which a truly normal labour depends; this knowledge does not as yet exist and even the want of it is not realized by most people; (ii.) labour in a healthy woman, secured by antenatal care; (iii.) labour under clean conditions, avoiding accidental infection (the old-time puerperal fever). Successful antenatal care is shown by ease of labour, good recovery and vigour of infant.

Uterine inertia is weakness or inefficiency or deficiency of the uterine contractions, especially as exhibited in labour.

What is labour itself? It is the expulsion by a hollow, plain muscular organ (the uterus) of its contents (the ovum) by its own muscular action. Labour may be compared with micturition, defecation and heart action. All these are painless when healthy; all may be painful when unhealthy. Uterine action may be studied in menstruation as well as in labour. Menstruation is normally painless, yet it is only recently that medical men have realized that this is so. Perhaps they are mistaken also with labour. Some authors report that dysmenorrhœic women are especially liable to tedious and painful labour; repeated labours in the same woman tend to have the same general character; it is as if the physiological fault were permanent to the woman concerned.

What do we know of the uterine contraction? Very little. Its progressive study depends on the adoption of an absolute standard of normal uterine action, this we find in my definition of normal labour. By it we adopt the best and easiest labour known as our standard. From it we assume that a normal uterine contraction is both efficient and painless. Pain is an early or borderline symptom of uterine inertia.

Well defined inertia is diagnosed by the fatigue of the mother and delay in delivery. My definition permits us to recognize the incipient stages of uterine inertia, most necessary to theoretical advance and consequent improvement to practice. Painful uterine contraction is the first symptom, mechanical delay is a later sign. Physiological inefficiency may not merely precede the mechanical inefficiency but may not be enough to affect mechanical progress greatly.

There is an obvious gradation in the varying characters of labour as seen in practice and reported in the literature, from painless, through nearly painless (assisted and spontaneous), comparatively easy, average, comparatively painful and difficult to the obstructed and complicated labour proper. All these can be brought under the same theory if the normal uterine contraction be accepted as efficient and painless. Such a theory inspires the hope of attaining an average labour approximating



to the normal (painless) labour. This gradation of labours may be arranged in three main classes of practical value: painless, average and obstructive.

Painless labours comprise (i.) labours resembling a defaecation, (ii.) sleeping labours, the patient drowsing during the pains, (iii.) pathological painless labours, due to the mother suffering from some serious nervous disease, for instance myelitis or tabes.

Average labours, which I shall classify later by considering the functioning primarily of the first stage and then relating it to the second stage, using pain as a key to the classification.

Obstructive labours (bony contraction, bad lies and so forth) I am not considering, except to point out that in theory if a really efficient uterus meets an insuperable obstruction, it will continue in action till the uterus becomes tetanic or ruptures or the patient dies from exhaustion. If the uterus is somewhat inert, it may tire and uterine exhaustion set in without the occurrence of either tetanus or rupture. All true inertia of the uterus is therefore primary.

I have not been able to find any laboratory study of the uterus in labour, for the physiology of the uterus has been strangely neglected. I propose now to make a clinical study by applying the principles of Sir James Mackenzie's "Symptoms and their Interpretation," as well as his work on the action of the heart, to average labour. If his original and fertile mind had studied the uterus in action (labour) as he studied the heart in action, what wonderful progress might have been made. As it was he recognized the correspondence between labour pain and other pain, though offering no explanation of its occurrence, he described it as a viscerosensory reflex. We must look for (i) viscerosensory, (ii) visceromotor, (iii) organic and (iv) vasomotor reflexes and (v) for evidence of the individual functions of the uterine muscle as displayed in labour.

No muscle has such a big effort to make (and that only occasional) as the uterus in labour. The neglect of its study is extraordinary when one considers what light an understanding of its functions must necessarily throw on all plain muscle activities. In women the subjective symptoms can be observed as easily as the signs, so that our opportunities are great when once recognized. The uterine reserve force in an individual woman may be regarded as equal or unequal to menstruation, as equal or unequal to labour, as equal to the third stage but unequal to the first or second stages and so forth.

Dakin, whose account of uterine action is the best with which I am acquainted, described it as rhythmic, peristaltic, intermittent, involuntary; he distinguished contractility, relaxation, retraction and polarity of action between fundus and cervix. He recognized that the separate functions of the uterine muscle may be independently affected. Twenty-nine years ago he said: "There is good ground for believing that retraction goes on independently of contraction." The division, in description, of labour into three stages, of dilatation,

expulsion and placental delivery, is universally recognized.

Expulsion and dilatation usually go on separately; they may, however, go on together; in some of these latter cases œdema of the anterior lip occurs. The process in the first stage is purely physiological and medical and not yet mechanical. The size and shape of bony pelvis affect expulsion (second stage), but cannot unless very extreme affect dilatation (first stage). Expulsive power is but one of the functions of uterine muscle and it is probably the last to be abolished. Inertia may affect the different stages separately. It varies in degree and result in each stage. A very tedious first stage may be followed by a very tedious or a very active second stage. I have thought that a deficient first stage was not infrequently associated with a defective third stage, though the second stage may be very active and successful in the same case. It is as though different factors were responsible for the efficiency of the different functions.

The length and suffering of labour depend chiefly on the efficiency of the first stage contractions; certainly so in the absence of mechanical obstruction. It is in slow and painful first stages that one feels so assured that successful uterine action depends on some special conditions, not yet discovered by us, even if suspected.

In a clinical study special attention must be paid to the first stage in all cases, more particularly in a series of cases (for example, compare my analysis of Dr. Gibson's series of one hundred consecutive posterior presentations in THE MEDICAL JOURNAL OF AUSTRALIA of August 14, 1926). Such a study will clearly show that uterine function transcends mechanical conditions as a cause of delay in labour in Australia. Pelvic contraction is rare in Australia. Of fifteen forceps cases among eighty consecutive unselected cases the head was found in the pelvis in eleven at the end of the eighth month and in fourteen at the onset of labour. There was plainly no pelvic contraction causing hindrance in these cases.

Is uterine action neurogenic or myogenic?

As cases of painless and efficient labour have occurred in paraplegic women and in animals whose nerve supply has been divided, it seems clear that the stimulus to labour, the irritability, contractility, relaxation, retraction, tone and conductivity of the muscle are independent of the nervous system; no doubt viscerosensory and visceromotor and other reflexes depend on the integrity of the nerve supply. These considerations and an analogy with cardiac muscle action lead to the conclusion that the uterine muscle action is myogenic in origin. Activation may depend on normal irritability. However, no one knows what leads to the occurrence of labour itself. The fact that injection of pituitary extract induces labour in some and increases the efficacy of the uterine contraction in most, suggests that endocrine factors may play an important part.

A uterus imperfectly activated at the onset of labour may become more perfectly activated during its progress. Normal irritability must depend on the health of the muscle fibre. On what does activation

depend? Probably on something humoral which in its turn may depend on a stimulus received from the foetus which is becoming a foreign body. However, cases of missed labour and missed abortion show that there is much as yet too obscure for our understanding. Certainly false pains, niggling onsets, complaint of great pain, fatigue, tendency to bleed during the third stage and puerperium, after-pains and slow involution all show an inert uterus, at least comparatively speaking. Their common association suggests a faulty uterine action extending throughout labour and the puerperium. Such errors may be due to deficient activation or deficient irritability, weak contraction, faulty retraction, atony and the like, separately or together.

The death rate rises with the duration of labour; the duration of labour depends on the uterine efficiency; the delay in labour may necessitate interference and occasions yet greater exhaustion and lowered resistance; the interference and lowered resistance give a greater liability to infection, all really due to the initial constitutional fault underlying the length of labour; all are correlated in causation. Uterine inertia, pain in labour and the liability to the fatal complications of motherhood and early infancy are bound up together.

Why is first labour notoriously the worst? Is it that the uterus is imperfectly activated for this labour, but retains some of its activation thereafter? Such a theory would explain the cure of dysmenorrhœa by labour. I have met women whose later labours were said to be worse than their first. Perhaps this is from a progressive cause depreciating their health and their uterine efficiency, for example dental sepsis.

Inefficient contraction of the uterine muscle and exaggerated sensibility to pain may be due to the same circulating (humoral) cause affecting both uterus and nervous system.

#### Symptomatology of Uterine Inertia.

By taking patients' statements and complaints seriously we may hope to evaluate symptoms. These are real and due to specific causes. Symptoms precede signs and may disappear before signs have time to appear. If we classify by symptoms and signs we may learn to diagnose the ultimate causes of the variations occurring in child-birth.

Let us assume that every woman who complains of pain, really has pain. We must allow for the natural temperament in assessing its amount and intensity, just as we do in any other kind of pain, but no more and no less. Symptomatic observation of both first and second stages is necessary. Vaginal examination is essential to the early diagnosis of serious uterine inertia. The general practitioner has an intuitive knowledge of this fact; even the specialist forbids it only to the general practitioner, not to himself!

Labour pain is a referred pain, a viscerosensory reflex. It is a border line symptom. Delivery may occur naturally, though pain be severe. Most accoucheurs will admit, however, that other things

being equal the greater the complaint of pain, the less likely is spontaneous delivery.

Labour pain may be compared with other colics and with *angina pectoris*, all of which pains are related to the contraction of plain (or cardiac) muscle of hollow organs and occur during contraction. The relation of the pain to the uterine contraction is quite definite clinically. It occurs with the contraction, increases with it and dies away with it. Indeed, no contraction, no pain! We cannot say, however, no pain, no contraction, for painless contractions of the uterus are known to occur during pregnancy in most patients, while in the rare case of painless labour there is active and efficient contraction leading to rapid and spontaneous delivery, but without pain! In some patients the later contractions of pregnancy are painful and are known as "false pains" because they do no work. Anyone who observes his patients with false pains, knows that there is among them a high proportion with niggling onsets, slow first stages and troublesome after-pains. It seems likely that the activation or the irritability of the uterus is at fault in these cases, sometimes only early in labour, sometimes throughout the whole process of child-birth. False pains may be taken as one of the earliest indications of uterine inertia.

In some patients labour pain is continuous but with rhythmic exacerbations; perhaps in these patients tone is abnormally high.

The pain varies in situation and severity and seems to be much exaggerated by the coexistence of another cause of pain, for example pyelitis or cystitis. This corresponds with a similar effect on menstrual pain. Most commonly labour pain is felt in the sacral region or in the lateral or iliac regions of the abdomen. It may be felt in both places separately or together. It is sometimes only suprapubic. A painful cramp of the legs may also occur in some. Perhaps this is a visceromotor reflex of sufficient strength itself to cause pain. A Christian scientist who had a painless primiparous labour, complained of aching in her legs while labour progressed (not regarded as a labour pain by my informant). I was inclined to compare it with the "cramps" so common in labour. This patient complained of an "opening and shutting feeling," when the head was found to be dilating the vulva.

The frequency of uterine contraction varies. It may be very frequent or very seldom and with little complaint of pain even where there is considerable inertia, but in most patients the pain is both severe and exhausting, especially where the contractions are both frequent and futile.

The main pathological visceromotor reflex is a vaginismus. It may grip head and obstruct the uterine efforts and even hinder forceps delivery. I have known it to grip child's shoulders, so sacrificing its life. I have recognized this reflex only lately; the patients were primiparous, with tedious dilatation, much pain and fatigue. The expulsive pains appeared to be effective and yet no advance was made. The

head was well down in the pelvis before the onset of labour and in most the occiput was anterior throughout and the vagina was so contracted as to make examination difficult. The perineum is especially liable to tear in these patients. I think that the reflex contraction of the perineal and vaginal muscles stands in actual causative relation to the tear. In many patients a tear starts before the head is even crowned, while in other labours the head is born without the slightest indication of tearing, even though no particular support be given. Possibly the extensibility and elasticity of the skin and subcutaneous tissues may also themselves be affected as well as the muscles of the parturient tract. Deep anaesthesia appears the only treatment for it, the usual light anaesthesia being useless in the worse cases. I have used Dr. Trinca's device (an artificial hand by which the mother makes pressure on the sacral region during the pains) which aims at decreasing pain by increasing uterine efficiency both reflexly and by an improved purchase; it relieves the viscerosensory reflex of pain in most, but it does not abolish the visceromotor reflex of vaginismus in all, though it probably prevents it in some. I intend trying atropine in my next case. Dr. Montgomerie Paton says that antiphtheritic serum given orally changes the character of the uterine contraction. A midwifery nurse told me that she knew of some women being taught during pregnancy to relax these parturient muscles. This seems to me a rather hopeful way of preventing the occurrence of this reflex.

Bearing down may be regarded as the really normal visceromotor reflex of labour; it is certainly the helpful reflex. Good bearing down is well recognized as a sign of efficiency in labour. It is from these muscular efforts that labour has received its name. Good bearing down may occur with vaginismus and spontaneous delivery may then fail. In Australia vaginismus is a more frequent hindrance to labour than is pelvic contraction.

Vomiting and shivering may be regarded as organic reflexes.

The cyanosis observed in some patients, the distressed breathing in others are perhaps vasomotor reflexes.

Pain and the visceromotor reflex are not the only indications of uterine inertia. Confirmatory evidence is offered by the complaint of fatigue, while examination shows either slow progress of dilatation or delayed advance of the head. A rising pulse rate and temperature and obvious exhaustion are definite evidence of a serious degree of inertia.

Bearing down, the sense of pressure, the sense of advance, the sense of impending defaecation, the sense of something to be expelled are all indicative of efficiency and occur both in painless labours and in those painful labours where spontaneous delivery may be expected.

"No two labours are quite alike." Labour tends to have the same character in repeated labours in the same woman. A classification of average labour will enable us to approach child-bearing with an analytical mind. It forces us to heed symptoms

and seek their relation to individual functions. It provides a foundation for a useful laboratory, clinical and electro-utero-graphic research.

#### Classification of Common Variations of Average Labour.

Class I.—Considerable complaint of pain, but with fair dilatation; the second stage varies.

(i.) One patient had to be delivered with forceps for hindrance by a short cord; there was certainly some inertia of the second stage (Case 29).

(ii.) Presence of some other source of pain, for example pyelitis. A patient complained bitterly of pain, but delivered herself speedily. In this class the inertia is mild in both stages, while some factor apart from uterine function is responsible for some of the delay or pain (Case 11).

Class II.—Bitter complaint of pain during first stage with slow dilatation, but spontaneous delivery (Case 13). In this class the inertia affects the first stage chiefly, while the second stage is of average efficiency or better.

Class III.—Bitter complaint of pain and slow progress in both stages. In this class the inertia affects both stages and is evidenced by suffering and comparative futility.

Class IV.—Slow progress of both stages with little complaint of pain and no distress. One patient lost her baby; this occurred before I began my functional study of *inertia uteri* (Case 36).

Class V.—(i.) Painful but effective dilatation, followed by a comparatively easy expulsion (Cases 2, 47, 48).

(ii.) Dilatory painful first stage followed by a very rapid second stage. This class illustrates the fact that inertia may affect the stages separately, whereas Class III. shows it affecting the stages in sequence.

I have no record of a second stage being more inert than the first. In one of Dr. Gibson's patients this peculiarity was present, but I thought the explanation might be a transposition of figures, so I have not made a separate class for this occurrence. However, in nearly painless labours the two or three pains which usually occur, appear to be second stage pains, thus reversing the usual rule of good first stages being followed by better second stages.

Class VI.—Severe pain, dilatation and expulsion going on together. Spontaneous and quick deliveries usually occur, but not always (Case 22).

Class VII.—The patient with false pains at the end of pregnancy often has a niggling onset of labour, sometimes a very long first stage (the second stage varies) and may be much troubled with after pains. These features seem to offer related evidence of some fault in the function of the uterine muscle, especially in its activation or its irritability. As expulsion may be very good in some of these patients, it appears that "dilatation" and retraction depend on at least partially different factors from those on which expulsion depends.

The third stage may be looked on as a labour in little. The cervix is already dilated, but the pla-



centa has to be separated and then expelled. The really important function is probably retraction as, if that is defective, hæmorrhage may occur. Many difficult labours give no trouble whatever during the third stage. This is not remarkable as the task of the uterus then is by no means so strenuous as during the earlier stages, so that an inertia sufficient to embarrass the first and second stages, may be insufficient to display itself during the third stage.

(i.) Bleeding may occur during separation of the placenta, but not thereafter.

(ii.) Expulsion may be quite spontaneous with little bleeding or nearly spontaneous with little bleeding. Contraction and retraction are good.

(iii.) Spontaneous expulsion may be followed by bleeding, good contraction, but retraction.

(iv.) There may be good contraction of uterus after the birth of the placenta, but with each relaxation hæmorrhage occurs. Is retraction the faulty factor?

(v.) Nipping of the placenta or membranes in the cervix may occur. Even the body of the child was caught in one instance, as if the fault were in the cervical action, perhaps an error in polarity.

Slow involution is often due to general rather than local causes and is related to the inertia shown in labour. In Dr. Giommi's painless labours he particularly noted the unusually rapid involution. No doubt after-pains are another evidence of inertia; not every *multipara* has them, while some suffer terribly.

In short we can find evidence of good or defective uterine function throughout all uterine activity, from dysmenorrhœa or menorrhagia, through pregnancy (false pains), the various stages of labour and the puerperium. In the individual it is not rare to find faulty action in all or many of these.

#### Causation of Uterine Inertia.

Sound medical health is necessary to healthy physiological reactions on the part of the mother and baby. The proved advantage of antenatal care is itself sufficient evidence that their welfare depends chiefly on general health. As dysmenorrhœa and the like depend on general health so does dystocia. The welfare of the mother and baby are wrapped up together; the mother is both nest and food supply for her infant. If she is short in her food supply or is poisoned in any way, the fœtus must suffer. Everyone admits this in the gross toxemias of pregnancy. It is equally true in minor conditions of ill-health. Painful labour may be correlated in causation with the prevalence of dead and weakly babies. The abolition of pain in labour will greatly reduce our early infantile death rate.

A humoral pathology offers the immediate explanation of much uterine inefficiency. That the constitution of the circulating fluids is of immense importance to physical and mental efficiency is sufficiently shown by "Insulin" reactions in the clinic and Ringer's fluid in the laboratory. No doubt the exact content of the body fluids affects all tissues and so important is a suitable pabulum to all organs

that even a minute error shows itself by subjective symptoms of unpleasant character long before objective signs are observable. The doctor must seek causes of symptoms in the general health.

General health depends on at least five groups of factors: (i.) Intake—diet, air, water, drugs (tobacco, alcohol, poisons *et cetera*); (ii.) infections, focal, local, general; (iii.) heredity; (iv.) trauma; (v.) habits of life, work, exercise, previous history. All these must be investigated and errors sought and corrected. In men humoral ill-health may lie latent, while in menstruating and especially in child-bearing women it is made patent to all. Humoral ill-health may provide a suitable soil for the flourishing not only of maternal and infantile morbidities, but probably also for caries, cancer and tuberculosis. In tuberculosis a suitable soil is well known to be as necessary as the actual bacillus. The health of women and children is an index of the health of the nation just as their status is an index of national civilization.

We return in some degree to the old Greek theory of "humours" for the explanation of functional ill-health. The very number and apparent disconnection of the symptoms suggest a common source with access to the circulation.

The practical absence of rickets in Australia gives a golden opportunity for the study of delay in labour uncomplicated by obstruction.

According to the textbooks the causes of definite inertia fall under the triple grouping of reflex, mechanical or constitutional. It is in the last that we must seek the causes of primary inertia; the others are but secondary.

True primary inertia is due to faulty action of the uterine muscle itself and is shown by the effect of the individual uterine contraction both in the work accomplished and the reflexes produced by it. The immense variation in the intensity of labour pain in different women is sufficient proof that there must be other causes than necessity for its occurrence.

Women suffering from pulmonary tuberculosis are well known to have comparatively easy labours, while some women of fine physique have long and painful labours. Is this due to some specific defect affecting the uterine muscle?

In some women there is faulty conformation of the uterus—underdevelopment, myoma and so forth. In these it is reasonable to expect faulty functioning. The presence of toxins in the system must affect the health of the uterine muscle. As cardiac muscle in the laboratory requires a circulating fluid (Ringer's) made "just so," so does uterine muscle in the body require a circulating fluid made "just so," not only as regards minerals and mineral balance, but as regards endocrine factors and absence of toxins and perhaps other factors. A physiological fault affecting uterine efficiency may be permanent to the woman concerned. Its discovery might lead to its correction. Reproductive health depends largely on diet as well as on the absence of exogenous or endogenous poisons with access to the circulating fluids.

(To be continued.)



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